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INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISSIPPI RIVER BASIN

by

Malcolm P. Keown, Elba A. Dardeau, Jr., James G. Kennedy

Mobility and Environmental Systems Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

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Final Report

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An inventory of the sediment sample collection stations in the Mississippi River Basin pertinent to the mission of the Corps of Engineers was conducted; 433 stations were located. Data for the 433 stations are presented in tables. For stations on the Arkansas, Atchafalaya, Kansas, Mississippi, Missouri, Ohio, Old, and Red rivers, these data include the river mile, water resource region, Corps of Engineers (CE) District, Office of Water Data Coordination (OWDC) station number, agency station number, station name, geographic coordinates of the

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station location, type of water body on which the station is located, period of record of the station, frequency and types of data collected at the station, method used to collect sediment samples, and agency reporting to the OWDC regarding sediment collection activities at the station. For other streams in the basin on which stations are located, the data in the tables include the CE District, OWDC station number, station name, period of record, and agency reporting to the OWDC. In addition, narrative summaries were prepared for 74 key stations selected on the basis of location, period of record, and reliability of reported data. The summaries are presented in Appendix A, and include information on the station site location, the collection and laboratory analysis of sediment samples taken at the station, and the reduction and reporting of the resulting data.

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PREFACE

The study reported herein was conducted during 1976 at the U. S. Army Engineer Waterways Experiment Station (WES) for the U. S. Army Engineer District, New Orleans (NOD), as part of the Lower Mississippi Valley Division (LMVD) Potamology Program (T-1), Work Package 9, Sedimentation.

The study was conducted by personnel of the Environmental Simulation Branch (ESB), Environmental Systems Division (ESD), Mobility and Environmental Systems Laboratory (MESL), under the direct supervision of Mr. J. K. Stoll, Chief, ESB, and under the general supervision of Messrs. W. G. Shockley, Chief, MESL, and B. O. Benn, Chief, ESD. Messrs. M. P. Keown and E. A. Dardeau, Jr., ESB, planned the study and conducted the investigations necessary to attain the project objectives. Messrs. J. G. Kennedy, Data Handling Branch, Mobility Systems Division, MESL, L. Rodriguez, ESB, M. R. Weathersby, ESB, and G. R. Crist, Publications and Graphic Arts Division (P&GAD), and Mme. P. A. Birchett, P&GAD, contributed significantly to this effort. Messrs. Keown, Dardeau, and Kennedy prepared this report.

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(1) Lower Mississippi Valley Division

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CONTENTS

CONVERSION FACTORS, METRIC (SI) TO U. S. CUSTOMARY AND U. S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

Units of measurement used in this report can be converted as follows:

Multiply	By	To Obtain
	Metric (SI) to U. S. Customary	
millimetres	0.03937007	inches
centimetres	0.3937007	inches
metres	3.280839	feet
cubic centimetres	0.06102376	cubic inches
milligrams	2.204622×10^{-6}	pounds (mass)
grams	0.002204622	pounds (mass)
millilitres	0.000264172	gallons (U. S. liquid)
milligrams per litre	6.242797×10^{-5}	pounds per cubic feet
grams per litre	1.0	parts per million
Celsius degrees or Kelvins	1.8	Fahrenheit degrees*
	U. S. Customary to Metric (SI)	
inches	25.4	millimetres
inches	2.54	centimetres
feet	0.3048	metres
yards	0.9144	metres
miles (U. S. statute)	1.609344	kilometres
square miles	2.589988	square kilometres
acres	4046.856	square metres
acre-feet	1233.482	cubic metres
pints (U. S. liquid)	4.731765×10^{-4}	cubic metres

(Continued)

* To obtain Fahrenheit (F) degrees from Celsius (C) readings, use the following formula: $F = 1.8(C) + 32$. To obtain Fahrenheit readings from Kelvins (K), use: $F = 1.8(K - 273.15) + 32$.

Multiply	By	To Obtain
U. S. Customary to Metric (SI) (Concluded)		
cubic feet per second	0.02831685	cubic metres per second
ounce (mass)	28.34952	grams
pounds (mass)	0.4535924	kilograms
tons (short)	907.1847	kilograms
Fahrenheit degrees	0.555	Celsius degrees or Kelvins*

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (0.555)(F - 32)$. To obtain Kelvin (K) readings, use: $K = (0.555)(F + 459.67)$.

INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISSIPPI RIVER BASIN

PART I: INTRODUCTION

Background

1. The continuous process of sediment transport and deposition in the streams of the Mississippi River Basin has resulted in a variety of problems that must be dealt with by U. S. Government and state agencies and the private sector. Although there has always been measurable sediment flow in the streams of the basin, intensive use of the land for agricultural purposes during the later part of the 19th century and early part of the 20th century resulted in streams that were heavily laden with sediment. Because of the increased sediment present in the streams, the design life of flood-control reservoirs was reduced, navigation channels became shallow or impassable, public water supply purification became more expensive, and water needed for agricultural and industrial purposes deteriorated in quality. Eroded farmlands became useless for agricultural activities, and the abandoned areas compounded the problem because there was no vegetative cover to inhibit further erosion induced by natural forces, such as wind and rain. Also, as more economical methods for the surface mining of coal were developed in Appalachia, these activities contributed great quantities of sediment to streamflows.

2. As the availability of virgin farmland decreased and navigation, flooding, and water-quality problems increased, it became apparent that a basin-wide effort must be implemented to significantly reduce sediment discharges into all main stem waterways and tributaries of the Mississippi River Basin. Programs were initiated by several U. S. Government and state agencies to reduce stream sediment loads and conserve valuable topsoil. The participating Federal agencies included the Army Corps of Engineers (CE), the Forest Service, the Bureau of Reclamation, the U. S. Geological Survey (USGS), the Soil Conservation Service,

and the Tennessee Valley Authority.

3. As a part of this basin-wide effort, farmers were encouraged to use contour plowing techniques; lands denuded of vegetation were replanted with trees and grass; small dams were constructed on higher-order streams; and streambanks were stabilized. Also, beginning in the early 1930's, a series of multipurpose dams was constructed on the Tennessee, Missouri, and Kansas river tributaries to conserve water, control flooding, generate hydroelectric power, provide public recreation areas, and act as sediment traps. As a result of these efforts, sediment loads in the Mississippi River and its tributaries were measurably reduced.

4. Although the collective results of the Federal and state programs to reduce stream sediment loads and conserve topsoil had positive results, it was difficult to assess the effectiveness of each program on an individual basis. Much sediment data was available for analysis; however, the reliability of the methods used for the collection of the samples, the laboratory analysis of the samples, and the reduction and reporting of the resulting data were not generally known on a basin-wide basis. An inventory was needed to locate those stations in the basin that had long periods of record and reliable data. The U. S. Army Engineer Waterways Experiment Station (WES) made a study to meet this need in 1930 and 1931 (References 1 and 2); however, these documents are now outdated, and current (1976) information is needed on sediment sample collection stations pertinent to the Corps mission in the basin.

Purpose and Scope

5. The purpose of the effort described herein was to update previous WES sediment investigations.[1,2] This study includes a general discussion of the effects of physiographic and cultural conditions on the sediment flow in the Mississippi River Basin, a comprehensive inventory of sediment sample collection stations pertinent to the Corps mission in the Mississippi River Basin, and narrative summaries (Appendix A) for key stations selected from the inventory. The stations

tabulated in the inventory include those that have data that would be useful for evaluating the effectiveness of various techniques used to reduce the sediment load in the streams of the basin or for assessing new methods for reducing sediment loads.

Definitions

6. Special terms used in this report are defined below.

   a. Bed (or streambed). The bottom of a water course.

   b. Bed load. The sediment that moves in essentially continuous contact with the streambed.

   c. Bed-load discharge. The quantity of bed load passing a cross section of a stream in a unit of time.

   d. Bed material. The composite of in situ and fluvially transported substances lying on and including the streambed.

   e. Composite sediment sample. A single sample formed by combining all the individual samples that pertain to a single sampling unit.

   f. Depth-integrated sample. A water-sediment mixture that is accumulated continuously in a sampler that moves vertically at an approximately constant transit rate between the surface and a point a few inches above the streambed and that admits the mixture at a velocity about equal to the instantaneous stream velocity at each point in the vertical. Because the sampler intake is a few inches above the sampler bottom, there is an unsampled zone a few inches deep just above the streambed.

   g. Depth integration. A method of sediment sampling to obtain a representative sample of the water-sediment discharge from every part of a stream vertical, except in a small unsampled zone near the streambed.

   h. Discharge. The volume of water (including all suspended materials) that passes a point in the stream network during a specific time interval.

   i. Discharge rating curve. A curve fit to a plot of known values of discharge versus stage, from which unknown discharges can be estimated for a known stage.

   j. Dissolved solids. The anhydrous residue of the dissolved substances in water, not including gases or volatile liquids.

   k. Equal-discharge-increment method. A technique to collect

suspended-sediment samples at centroids of area that represent equal discharges through computed areal increments of the channel cross section. This method is limited to streams with stable channels for which discharge rating curves vary little during the year.

l. Equal-transit-rate method. A cross-sectional suspended-sediment sampling technique that requires a sample volume proportional to the amount of water flow at each of several equally spaced verticals in the cross section. This equal spacing between verticals across the stream and an equal transit rate (ETR), both up and down in all verticals, yield a sample that represents the total sediment load.

m. Fluvial sediment. See "sediment."

n. Gage height. The water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the general term "stage," although gage height is more appropriate when used with a reading on a gage.

o. Grab sample. A single sample taken from a stream cross section, usually to determine suspended-sediment concentration. Estimation of suspended-sediment discharge from a grab sample is often in error.

p. Particle-size classification. The classification used in this report agrees with recommendations made by the American Geophysical Union Subcommittee on Sediment Terminology. The classification is as follows:

Classification	Size, mm*
Clay.	0.00024 - 0.004
Silt.	0.004 - 0.062
Sand.	0.062 - 2.0
Gravel.	2.0 - 64.0

q. Particle-size distribution. The proportion of material of each particle size present in a given sample.

r. Point-integrated sample. A water-sediment mixture that is accumulated continuously in a sampler that is held at a relatively fixed point in a stream and that admits the mixture at a velocity about equal to the instantaneous current velocity at the point.

s. Point integration. A method to obtain a sample that represents the mean concentration of suspended sediment in

* A table of factors for converting metric (SI) units of measurement to U. S. customary units and U. S. customary units to metric (SI) units is given on page 7.

the discharge passing a point in a stream during the sampling interval.

t. River mile. Distance along a stream (in U. S. statute miles) as measured from a reference point, usually the confluence of one stream with another or a selected point within the stream's delta or estuary.

u. Sampling vertical (or vertical). An approximately vertical path from the water surface to the streambed along which samples are taken to determine the sediment concentration.

v. Sediment (or fluvial sediment). The solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are slope, length of slope, soil characteristics, land use, and duration and intensity of precipitation.

w. Sedimentation. That portion of the metamorphic cycle from the separation of particles from parent rock to, and including, their consolidation into another rock. Sedimentation, thus, includes a consideration of the sources from which the sediments are derived; the methods of transportation from the places of origin to those of deposition; the processes, agents, and environments of deposition; the chemical and other changes taking place in the sediments from the time of their production to their ultimate consolidation; the climatic and other environmental conditions prevailing at the place of origin, over the regions through which transportation takes place, and in the places of deposition; the structures developed in connection with deposition and consolidation; and the horizontal and vertical variations of sediments.

x. Sediment range. A cross-sectional plane of a stream, usually normal to mean direction of flow, in which two or more verticals are taken in order to determine the concentration, particle-size distribution, or other characteristics of the sediment load.

y. Sediment rating curve. A curve fit to a plot of known values of sediment load versus discharge or stage, from which unknown values of sediment load can be estimated for a known discharge or stage.

z. Sediment station. A location where sediment samples are collected.

aa. Sediment yield. The total sediment outflow from a

watershed or a drainage area at a point of reference for a specified time interval.

bb. Streambed material. See "Bed material."

cc. Stream-gaging station. A location on a stream, canal, lake, or reservoir at which observations are made of discharge or water-level height on a gage.

dd. Suspended sediment. Sediment that is supported by the upward components of turbulent currents and which stays in suspension for appreciable lengths of time.

ee. Suspended-sediment concentration. The concentration of suspended sediment in the sampled zone, usually expressed as milligrams of dry sediment per litre of water-sediment mixture (mg/l).

ff. Suspended-sediment load or discharge. The quantity of suspended sediment passing through a stream cross section in a specified interval of time.

gg. Total sediment discharge (or total sediment load). The sum of the suspended-sediment discharge and the bed-load discharge. It is the total quantity of sediment, as measured by dry weight, that is discharged during a specified interval of time.

hh. Total sediment load. See "Total sediment discharge."

ii. Vertical. See "Sampling vertical."

jj. Water year. The period from 1 October through the following 30 September.

PART II: SEDIMENT FLOW IN THE MISSISSIPPI RIVER BASIN

7. The Mississippi River drains a basin (Figure 1) of 1,244,000 square miles or one eighth of the area of the North American continent. Included in the basin are all or parts of 31 states and 2 Canadian provinces (Alberta and Saskatchewan). Lake Itasca, Minnesota, is usually regarded as the source of the Mississippi River, but the actual beginnings of this great river system are Elk Lake and several lesser water bodies that empty into Lake Itasca. From this source in northern Minnesota to the delta at the southern tip of Louisiana, the waters of the Mississippi River travel a total distance of 2348 miles. If the length of the Missouri River is added to the length of the Mississippi River downstream from the Missouri-Mississippi confluence, this river system can be ranked as the third longest in the world (3986 miles), exceeded in length by only the Nile and the Amazon. When ranked with other world rivers in terms of drainage area, mean discharge, and mean daily suspended-sediment load, the Mississippi River ranks fifth, eighth, and eighth, respectively.

8. As the Mississippi River flows through the middle of the continent, it gathers the waters of hundreds of tributaries, no fewer than 45 of which are navigable for at least 50 miles, yielding a combined length of navigable waterways that exceeds 15,000 miles. The head of navigation on the main stem is at St. Paul, Minnesota. Upstream from this point, the Mississippi is a clear, fresh stream flowing through Minnesota lake country. From St. Paul to the confluence of the Missouri River north of St. Louis, Missouri, the river flows between steep limestone bluffs and collects waters of many tributaries in the upper valley, which led the Ojibway Indians to name it "Father of Waters," literally "Misi" (Big) and "Sipi" (Water). Downstream from the confluence of the Missouri and Mississippi, the river becomes a silt-laden meadering stream, as are many of its tributaries. However, as recently as 5000 years ago, the Mississippi River and its tributaries were braided streams.[3] The main stem is now considered to be in a poised state (i.e. neither aggrading nor degrading) and in a mature stage of valley development.

Figure 1. Mississippi River Basin

Physiography and Sediment Sources

9. The majority of the Mississippi River Basin is in the Great Plains and the Central Lowland Physiographic Provinces[4,5] of North America;* however, the basin is generally divided into five distinctive subbasins that are named after the major streams that drain the region. These subbasins are the Missouri, the Arkansas-White-Red, the Ohio-Tennessee, the Upper Mississippi, and the Lower Mississippi (Figure 1). A description of the physiography and sources of sediment in each of these subbasins is provided in the following paragraphs.

Missouri and Arkansas-White-Red Subbasins

10. The Missouri and the Arkansas-White-Red Subbasins have similar physiographies and are discussed together here. These subbasins are the greatest source of sediment in the Mississippi River Basin.[6] Rivers such as the Arkansas, Red, Kansas, Missouri, and Platte transport considerable volumes of sediment as they rise in the foothills of the Rocky Mountains and flow through the Great Plains. There is a wide, but gently sloping, mass of unconsolidated materials overlying the bedrock of the Cretaceous Age (135,000,000 years ago[7]). The prairie soils are highly susceptible to water and wind erosion. A number of the tributaries in this region are not only incised but also braided because their sediment loads are high in relation to their discharges.[5] Although precipitation in these western subbasins is minimal (usually 20-25 in. annually) and varies from year to year, the greatest part reaches the ground in the form of rainfall during the spring and summer months; thus, sediment loads are generally greater during this period than during other periods of the year.

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* Other physiographic provinces[4,5] drained by the Mississippi River are the Northern Rocky Mountains, Middle Rocky Mountains, Wyoming Basin, Southern Rocky Mountains, Ozark Plateaus, Superior Upland, Interior Low Plateaus, Appalachian Plateaus, Valley and Ridge, Blue Ridge, and the Coastal Plain.

Ohio-Tennessee Subbasin

11. The Kentucky, Green, Cumberland, and Tennessee rivers drain the Appalachian Plateau.[4] These streams flow through well-defined valleys into the Ohio River and eventually to the Mississippi River. The materials found in this region are less susceptible to erosion than those found in the Missouri and Arkansas-White-Red Subbasins. In the higher elevations, the rocks are well indurated and less affected by erosive forces; however, below the 1000-ft elevation contour in the area between the Tennessee and Ohio rivers are the softer limestones of the Carboniferous System (Pennsylvanian and Mississippian rocks 345,000,000 years old[7]). These limestones are subject to erosive action of the streams that do contribute to the sediment load of the Ohio River.[6] The glaciated areas north of the Ohio River, through which most of the right-bank tributaries flow, also are sediment contributors.

Upper Mississippi Subbasin

12. The upper portion of the Mississippi River Basin also drains a glaciated region, and today the upper river itself and its tributaries, e.g. Wisconsin, St. Croix, Rock, Illinois, flow through ancient glacial channels that provide sources of sediment.[6] That reach of the river between the Missouri-Mississippi confluence and the Ohio-Mississippi confluence (i.e. from St. Louis, Missouri, to Cairo, Illinois) is known as the "Middle Mississippi River."[8] Horberg[9] describes the present-day course of the Middle Mississippi River, emphasizing the physiographic and structural relations as follows:

> ...The present Mississippi...for a short distance in the vicinity of St. Louis flows in a broad valley...A few miles below St. Louis the valley narrows, and for more than 100 miles the river occupies a rock trough incised across the eastern flank of the Ozark Plateaus.

Lower Mississippi Subbasin

13. Below Cairo, the river flows through its own alluvial valley for approximately 600 miles. Fisk[3] discusses the character of the lower alluvial valley of the Mississippi.

> ...The main sediment load of the Mississippi River is brought into the valley by the Missouri, Arkansas, and Red Rivers, turbid

streams which impart to the Mississippi its muddy character. The Ohio River, although it supplies more than half the total discharge of the master stream, is less turbid...

The alluvial plain includes both the floodplain subject to seasonal flooding and dissected alluvial plains not completely covered by flood waters...The dissected alluvial plains, once a part of the river floodplain, are set off from the floodplain by definite escarpments frayed in places by many minor stream valleys...Streams have been the dominant agents in the construction of the alluvial plain, but only the latest epoch of the aggradational history can be interpreted from the present stream courses and from traces of their abandoned counterparts. Each floodplain stream maintains a highly sinuous course about the axis of which it constantly shifts to form meander loops and bends. Such channel shifting takes place within well-defined zones, meander belts, whose widths are determined by the size of the streams...

Streams of the valley have large stage variations and in their natural state periodically overflow their banks. Sediments deposited on the outside of bends during overflow stages form natural levees, low alluvial ridges which slope away from the river. Continued occupation of a meander belt causes natural levees of adjacent meanders to coalesce leaving continuous alluvial ridges in the floodplain. These meander-belt ridges rise above adjacent swampy lowlands to form the highest aggradational floodplain features.

Sweeping across the valley in great arcs, the present Mississippi meander belt impinges against the valley walls or alluvial ridges to inclose or block off large floodbasins, such as the St. Francis, Tensas, and Boeuf basins. Flood waters entering these basins drop their load of suspended sediments and slowly aggrade the valley surfaces...

14. The deltaic plain of the Mississippi River consists of at least five discernable subdeltas, each having its own distributary network.[10] All of these subdeltas have been formed in the past 5000 years or since sea level reached its present stage.[11] Fisk[3] refers to the present subdelta as "Balize," and Saucier[11] prefers "Plaquemines-Modern." Saucier states that the Plaquemines-Modern Subdelta is the only area in which active delta growth is taking place, and that a delta lobe has already begun to form in the Atchafalaya Bay, due to increased discharge through the Atchafalaya Basin. Kolb and Van Lopik[12] and Kolb[13] point out that this present "birdfoot delta" departs somewhat from the examples often found in textbooks, the differences being the small number of

major distributaries, the unusual permanency of the distributaries, the slow rate of seaward buildout or progradation, the unusually large rate of subsidence, and the abnormally great effect on marine processes. The present subdelta has formed in relatively deep water at the edge of the Continental Shelf. In the past century and a half, it has added some 50 square miles of land to the State of Louisiana.

15. In the classical sense, the beginning of a delta is at the first distributary. One fourth of the Mississippi River water (but not a proportional amount of sediment) enters the Atchafalaya River through the Old River Outflow Channel. Even though the natural processes are controlled to some degree by the present Old River Control Structure, the Atchafalaya Basin is becoming the site of the sixth subdelta.

Cultural Activities and Sediment Sources

16. Even without the influence of cultural activities, the Mississippi River would be a significant sediment carrier; however, cultural activities have accelerated the erosive processes. The North American Indians, who first inhabited the Mississippi River Basin, depended on the river as a source of fish; but by the time the first Europeans arrived in the valley (1541), the Indians had already begun agricultural activities. Throughout the period of French, Spanish, British, and later American control, development of agricultural and commercial activities increased, including the growth of many river ports. Man, in his attempts to control this river, gradually began to alter its hydraulic and sediment regimes.

17. The ancient Greeks were the first to realize that erosion and silting of rivers were accelerated by clearing of forests and intensive cultivation. By the 1920's, the engineering community had concluded that river mechanics were well understood and that the control structures that had been built in various parts of the basin were sufficient to regulate flows. The 1927 flood demonstrated that this conclusion was incorrect; farms, towns, transportation links, and human lives were lost as the streams of the basin carried billions of tons of irreplaceable

topsoil toward the Gulf of Mexico. Research was initiated first on physical modeling and later mathematical modeling of the Mississippi River system. The significant findings of these studies indicate that variations in discharge and sediment loads in the lower reaches of the main stem could be linked with activities (both natural and cultural) occurring in other parts of the basin. In the following paragraphs, the major known cultural practices that have led to increased sediment flow are discussed.

Agriculture

18. Although the mean annual rainfall in the Missouri and Arkansas-White-Red Subbasins is quite modest when compared with that in the remainder of the Mississippi River Basin, it is concentrated in a short time period resulting in heavy, but irregular, discharges and sediment flows. Agricultural practices in this region during the first half of this century have disturbed the soil and removed protective vegetation, resulting in an increase of sediment flow in the streams of this region. A CE sediment survey at St. Charles, Missouri, in 1879 indicated that the maximum suspended-sediment load measured at this location on the Missouri was 3,000,000 tons/day.[1] However, during the period immediately prior to closure of Gavins Point Dam in 1955, a maximum sediment load of 8,340,000 tons/day* was recorded at Hermann, Missouri, 70 miles upstream from the St. Charles sediment sample collection station. Agriculture is practiced throughout most of the Mississippi River Basin in the areas suited for this purpose, but none of the subbasins contribute sediment to the same degree as do the agricultural areas in the Missouri and Arkansas-White-Red Subbasins. Closure of key sediment control structures upstream from Hermann** have reduced the mean sediment load from 663,200 tons/day (1949-1955) to 275,100 tons/day (1970-present).

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* See narrative for Hermann, Missouri, in Appendix A.

** Hermann is the last sediment sample collection station on the Missouri River prior to confluence with the Mississippi River, and sediment data collected at this station is considered to be an indication of the Missouri River's sediment discharge into the Mississippi River.

Mining

19. Accelerated mining activities in the Ohio-Tennessee Subbasin have resulted in increased sediment loads in the streams draining this region. The major sources of sediment resulting from these operations are access roads to coal seams, refuse areas, and surface-mined areas prior to reclamation. Fishtrap Reservoir on the Big Sandy River, a left-bank tributary to the Ohio River, is becoming filled with sediment at a rate of 1.9 acre-ft/year/square mile, as compared with the design rate of 0.37 acre-ft/year/square mile, because of heavy surface mining in both Kentucky and West Virginia.[14] Also, a great deal of commercial sand and gravel dredging on the Ohio River and its tributaries has disturbed the in situ storage of sediment and has resulted in greater sediment concentrations downstream.

Geometric adjustments

20. Reservoirs have proven to be effective sediment traps (paragraph 19); however, the construction of reservoirs has resulted in significant changes in the hydraulic and sediment regimes of many streams. The waters coming over a dam spillway or through the gates have a greater sediment-carrying capacity than those waters entering the reservoir, and the river often seeks new material by scouring the stream bottom below the dam or cutting into the banks.[15,16] The Red River downstream from Denison Dam has deepened and widened its channel for approximately 100 miles since closure of the dam in 1943.

21. River straightening and dredging operations have resulted in increased flow velocities that enhance the capability of the stream to erode and transport sediment. Attempts by Government agencies and private land owners to implement streambank protection measures have often proven to be little more than stopgap efforts without sufficient consideration directed towards total bank control of the entire stream network. Although the troubled area may have been protected, the problem was often transferred to another reach.

Construction and urbanization

22. Each year more than a million acres of land in the United States are converted from agricultural use to urban use. The lands

cleared for construction are a source of much of the sediment that pollutes streams and rivers and fills lakes and reservoirs. Studies show that erosion on land that will be used for highways, houses, or shopping centers is about 10 times greater than on land in cultivated row crops, 200 times greater than on land in pasture, and 2000 times greater than on land in timber.[17] The amount of erosion that occurs is determined by the kind of soil, the slope, the intensity of rainfall, and the construction methods. Much of the erosion occurs during the construction period; however, areas below a construction site may erode more after construction is completed because of the rapid runoff from impervious pavement or compacted soil.

PART III: INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISSIPPI RIVER BASIN

Past Inventories

23. The first recorded sediment sample was taken in the Mississippi River Basin by CPT A. Talcott in 1838 near the mouth of the Mississippi. Since that date, a multitude of agencies have taken samples on both regular and irregular bases. The history of sediment sample collection activities in the basin, prior to 1930, is summarized in Reference 1. This document includes an inventory of 45 sites (some with narrative descriptions and tabulated sediment data) at which sediment samples had been collected. Descriptions and tabulated data are provided for 28 additional sites in Reference 2.

24. An inventory of sediment sample collection stations for the United States was prepared by the Federal Inter-Agency River Basin Subcommittee on Sedimentation in 1948,[18] which includes stations active through 30 September 1946. This inventory includes a tabular listing of 845 sediment sample collection stations in the Mississippi River Basin, 454 of which were on small streams, with the period of record of each station, the number of samples taken, the sampling equipment used, the types of data reported, and the sources of the information.

25. The format of Reference 18 has been modified, and a revised document has been published annually since 1953 (Reference 19). This annual report is a digest of information furnished by Federal agencies conducting sedimentation investigations on work in progress or planned, important findings, new methods, new publications, laboratory and other research activities, and other pertinent information. The material is organized by major drainage regions in the conterminous United States, Alaska, Hawaii, Puerto Rico, and foreign.

26. An excerpt from the "Catalog of Information on Water Data,"[20] complied by the USGS Office of Water Data Coordination (OWDC), is included as Appendix A of Reference 19. This excerpt is a list of

the long-term (3 years or more), water-quality stations where sediment sediment data have been collected.

Current Inventory

27. During the past 10 years, dredging costs incurred for maintaining navigation channels have rapidly escalated, standards for public water supplies have become more stringent, and agricultural interests have concluded that the loss of valuable topsoils cannot be tolerated. To minimize sediment flow in the streams of the Mississippi River Basin, the sediment transport and deposition regime must be understood. Prior to formulating a procedure for characterizing the basin sediment flow regime, an inventory must be conducted to determine where reliable data have been taken that could be used as the basis for formulating such a procedure. The needed inventory was conducted for sediment sample collection stations pertinent to the Corps mission in the Mississippi River Basin and is the subject of this report. The inventory includes stations on all first-, second-, and third-ordered streams in the basin, and some fourth-ordered streams in the Kansas River Basin. The procedure used to conduct the inventory is described herein.

Procedure

28. Initially, Reference 19 (1974 edition) was searched for sediment sample collection stations. This search yielded 354 stations on 88 rivers in the basin as of 1 January 1974. Reference 19 contains listings only for stations that have periods of record of three or more years; therefore, the possibility had to be considered that longer term stations where data would be collected for a period longer than 3 years had been established in the basin after 1 January 1971. This was true in the case of the National Stream Quality Accounting Network (NASQUAN), which was established in 1973. The catalog of the NASQUAN stations[21] was searched for additional stations. Also, all the CE and USGS Districts having jurisdiction in the basin were contacted to determine if there were stations that had been operated more than 3 years in their districts, which were not included in References 19 or 21. As a result of this effort, 79 stations that were established after 1 January 1971

were located, making a total of 433 stations in the basin. Stations that were at sites where sediment samples were taken prior to a significant change in the stream regime were eliminated from the inventory, e.g., several stations on the Upper Missouri were flooded by reservoirs and samples previously taken at these stations were thus not meaningful in evaluating present conditions.

29. The stations on the major streams in the Mississippi River Basin* were tabulated by river mile and are listed in Table 1 (includes 155 stations). The notations for Table 1 are provided in Table 2. The following information is included in Table 1 for each station:

a. River mile.**

b. Water resource region (WRR).

c. CE district.

d. OWDC station number.

e. Station agency number.

f. Station name.

g. Latitude.†

h. Longitude.†

i. Type of water body sampled.

j. Period of record.

k. Interrupted record.

l. Type of sample collected.

m. Method used to collect sediment samples.

n. Agency reporting to OWDC.

30. Most of these categories are self-explanatory; however, the following general comments are provided:

a. The river miles listed are those resulting from the most recent survey.

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* The Mississippi, Missouri, Kansas, Ohio, Arkansas, Red, and Atachfalaya rivers, and Old River.

** Measured from mouth to source, except for the Ohio River, in which river miles are measured from source to mouth.

† All latitudes are north of the equator, and all longitudes are west of the prime meridian; they are expressed herein according to OWDC convention (Reference 20). For example, 305857/1014754 is 30°58'57"/101°47'54".

b. The contiguous United States has been divided into 18 watersheds (WRR) arbitrarily numbered from east to west.

c. WRR Nos. 05, 06, 07, 08, 10, and 11 lie in the Mississippi River Basin and correspond to the Tennessee, Ohio, Upper Mississippi, Lower Mississippi, Missouri, and Arkansas-White-Red drainage basins, respectively.

d. The OWDC station numbers are unique numbers used by the OWDC for automated information retrieval.

e. Most agencies also attach a station agency number to each station for internal use.

f. The station name is generally the same as that of the nearest post office, except those stations near hydraulic structures, e.g. Below Wilson Dam, Kansas, or those stations not near a post office, e.g. Red River above Old River Outflow Channel.

31. The period of record for each station reflects as closely as possible the period for which sediment samples have been collected; however, Reference 19 notes that the listing was adapted from a more comprehensive listing of water-quality data acquisition activities, and the periods listed may not pertain to the record of sediment data only. As a part of this study, the periods of records were adjusted for all stations for which information was available on the sediment sample collection program.

32. The frequency of sample collection is listed for suspended-sediment concentration, suspended-sediment particle-size distribution, and bed-material particle-size distribution. The frequencies listed are those most recently reported. The frequencies reported in the "Other" column could refer to radioactive concentration, dissolved solid concentration, particle-size distribution, etc.

33. The method used to collect the suspended sediment sample at each station is denoted by the letters G, R, and V. "G" indicates that a grab sample was taken, usually meaning at a convenient point on the surface of the stream cross section. Because the sediment concentration can vary widely across a section, a grab sample may not be representative of the true sediment load and is generally not used to compute sediment load unless the stream is small or the sample is taken where

sediment in the stream is known to be of uniform concentration. "V" indicates that a single vertical sample was taken at the site. The single vertical nomenclature applies to a depth-integrated vertical or several point-integrated samples taken on a single vertical. "R" indicates a sediment range in which two or more vertical samples were taken. This category also includes sites in which a single vertical sample was taken by an observer, and the contract agency took a periodic series of vertical samples to determine whether a correction factor need be applied to the sediment load calculated from the sample taken by the observer.

34. The remaining 278 stations are not on major streams and are not included in the comprehensive listing of Table 1; however, these stations are listed by stream in Table 3. The station names are arranged in order of distance from the mouth of the stream and include the OWDC number, period of record, and agency reporting to OWDC. The listings of Tables 1 and 3 are also plotted on maps of the Missouri, Arkansas-White-Red, Ohio-Tennessee, Upper Mississippi, and Lower Mississippi Subbasins (Figures 2-6).

General observations

35. The literature search and conversations with various agency personnel contacted during the study revealed that there is wide variation among and within agencies relevant to (a) the methods used to collect and analyze sediment samples and (b) the procedures used to reduce and report the resulting data. Much of the information in agency files that was critical to the sediment data collection activities at the stations described in this report was found to be incomplete or inaccurate, especially regarding the methods used, agency responsibility, and laboratory analysis procedures. To assemble a complete and accurate historical record, many people who had retired from active agency positions were contacted to acquire needed information. These interviews served to preserve much of the historical information relevant to sediment sample collection and stream-gaging activities in the Mississippi River Basin that may have otherwise been lost.

36. During the conduct of the study, it was found that although many sediment samples are collected, a much fewer number are analyzed,

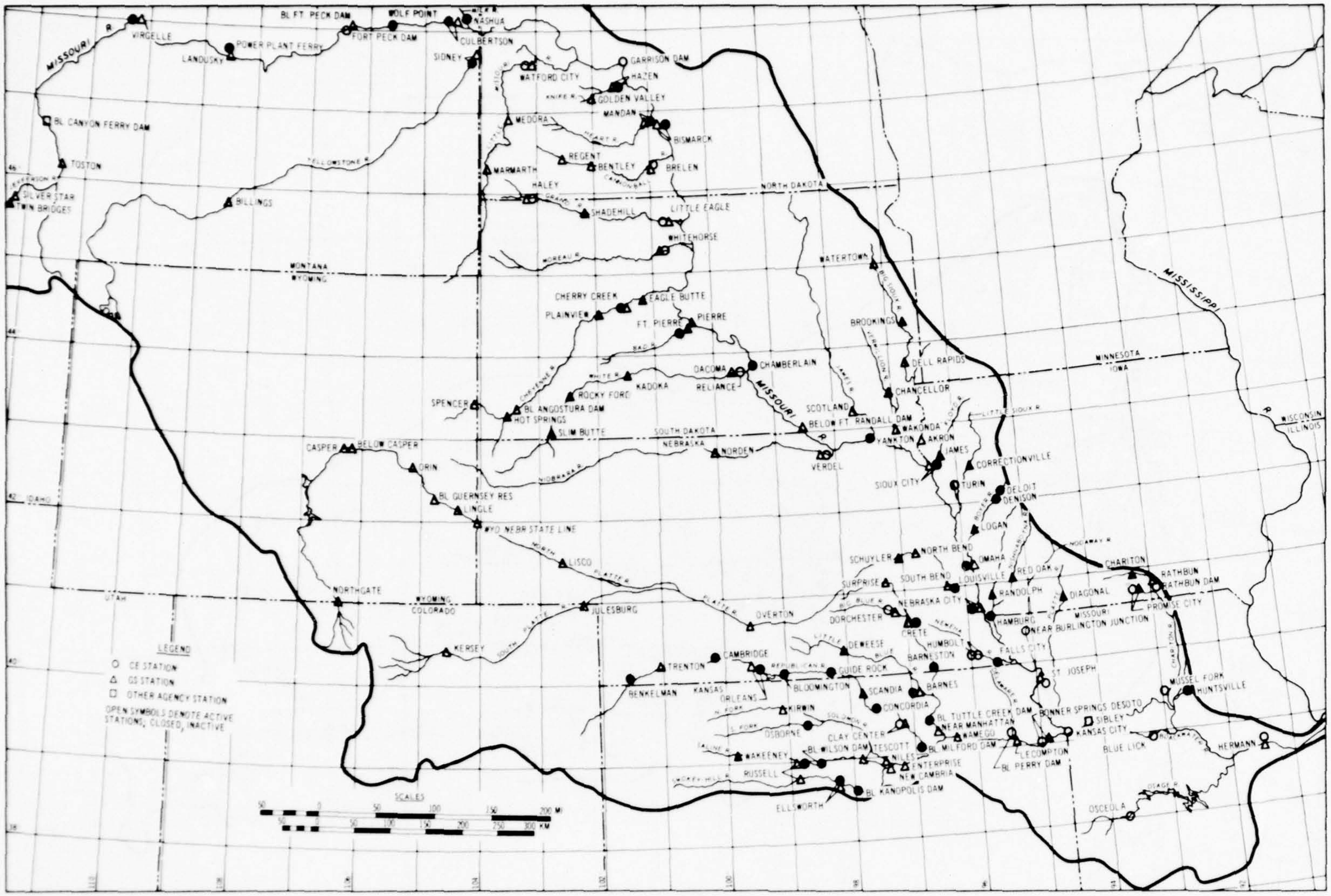

Figure 2. Missouri River Subbasin

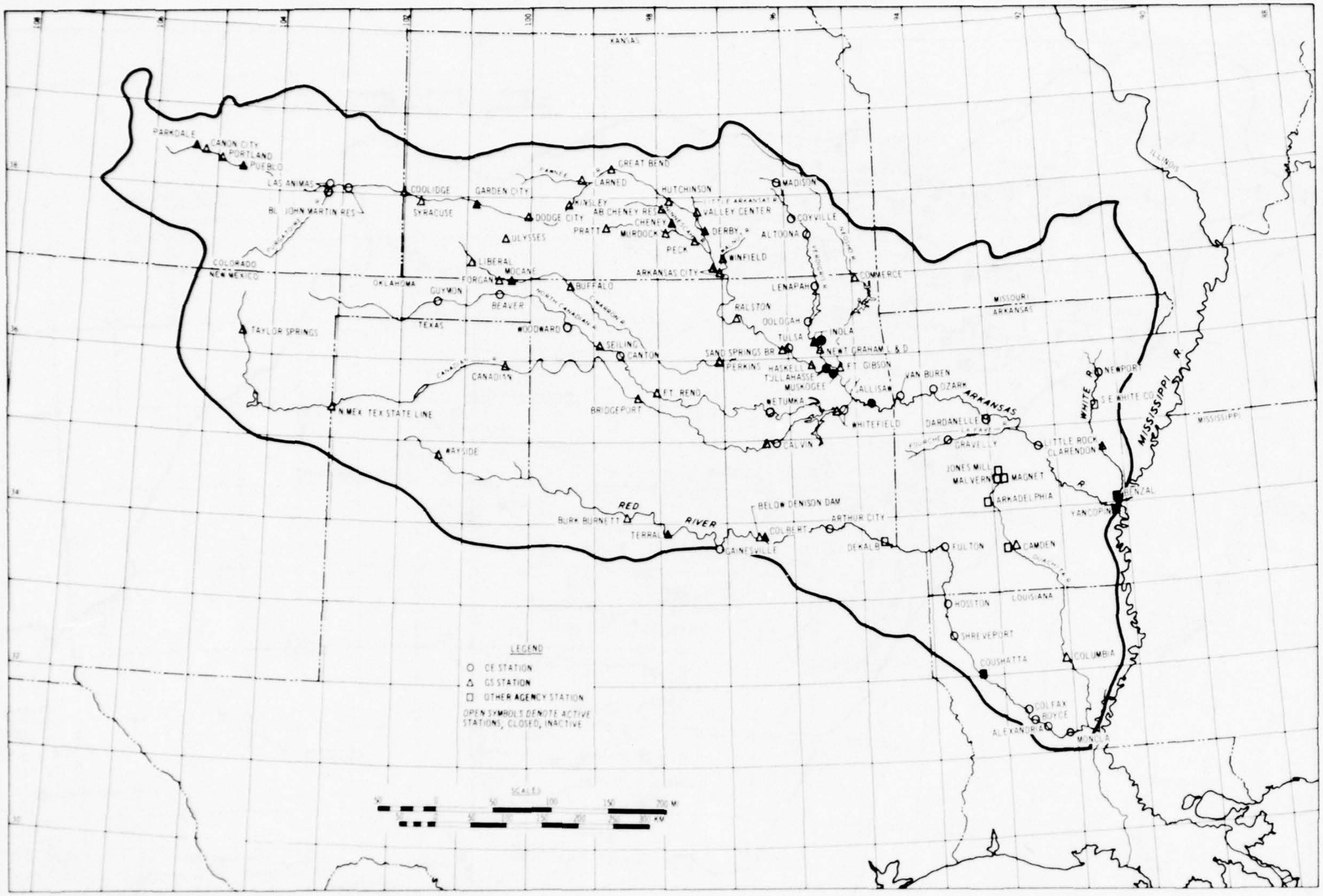

Figure 3. Arkansas-White-Red Subbasin

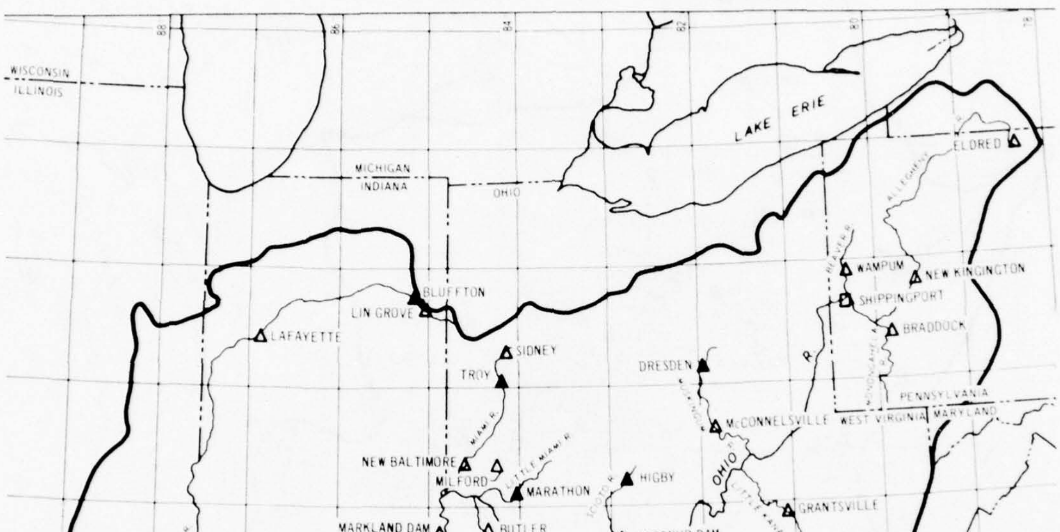

Figure 4. Ohio-Tennessee Subbasin

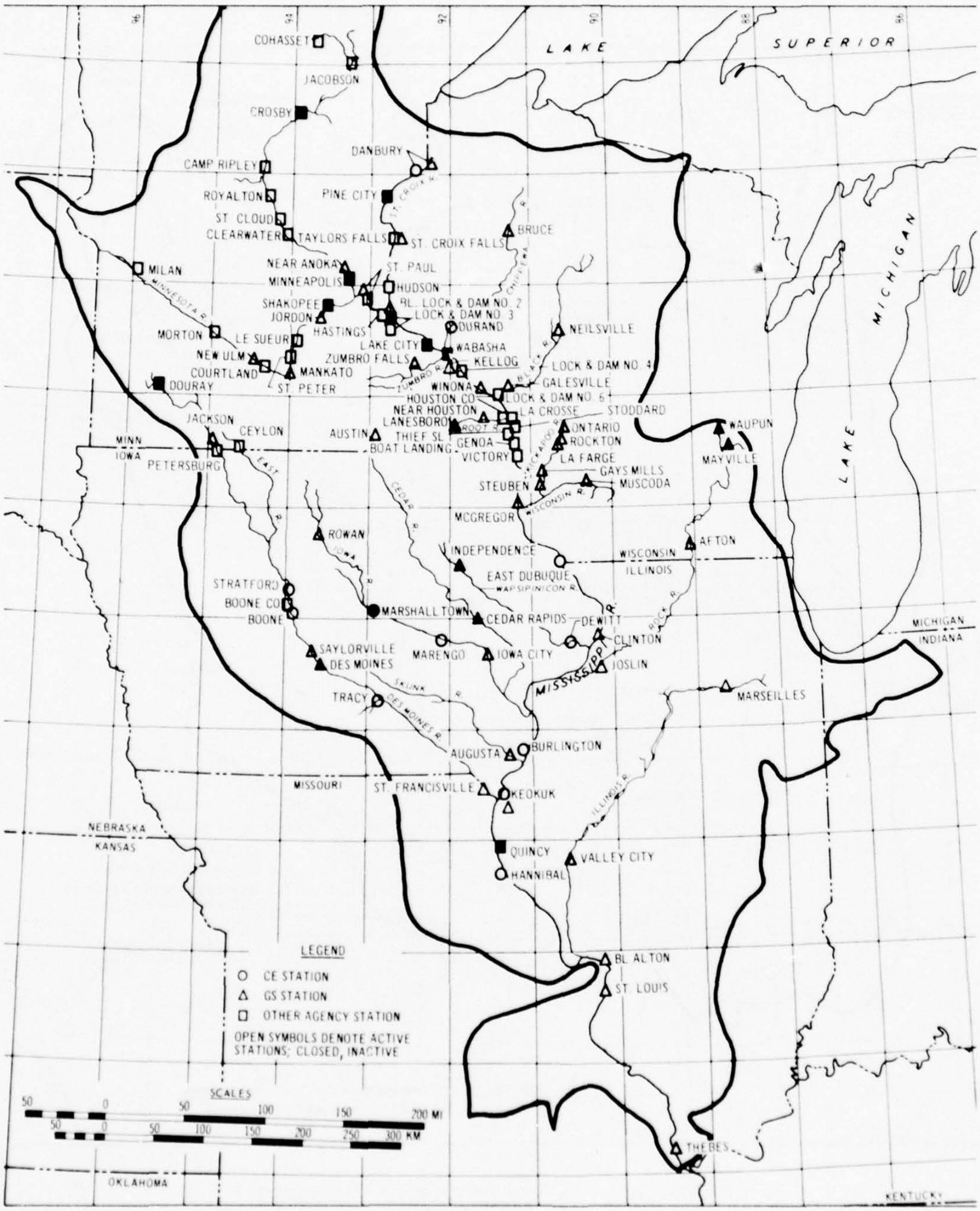

Figure 5. Upper Mississippi Subbasin

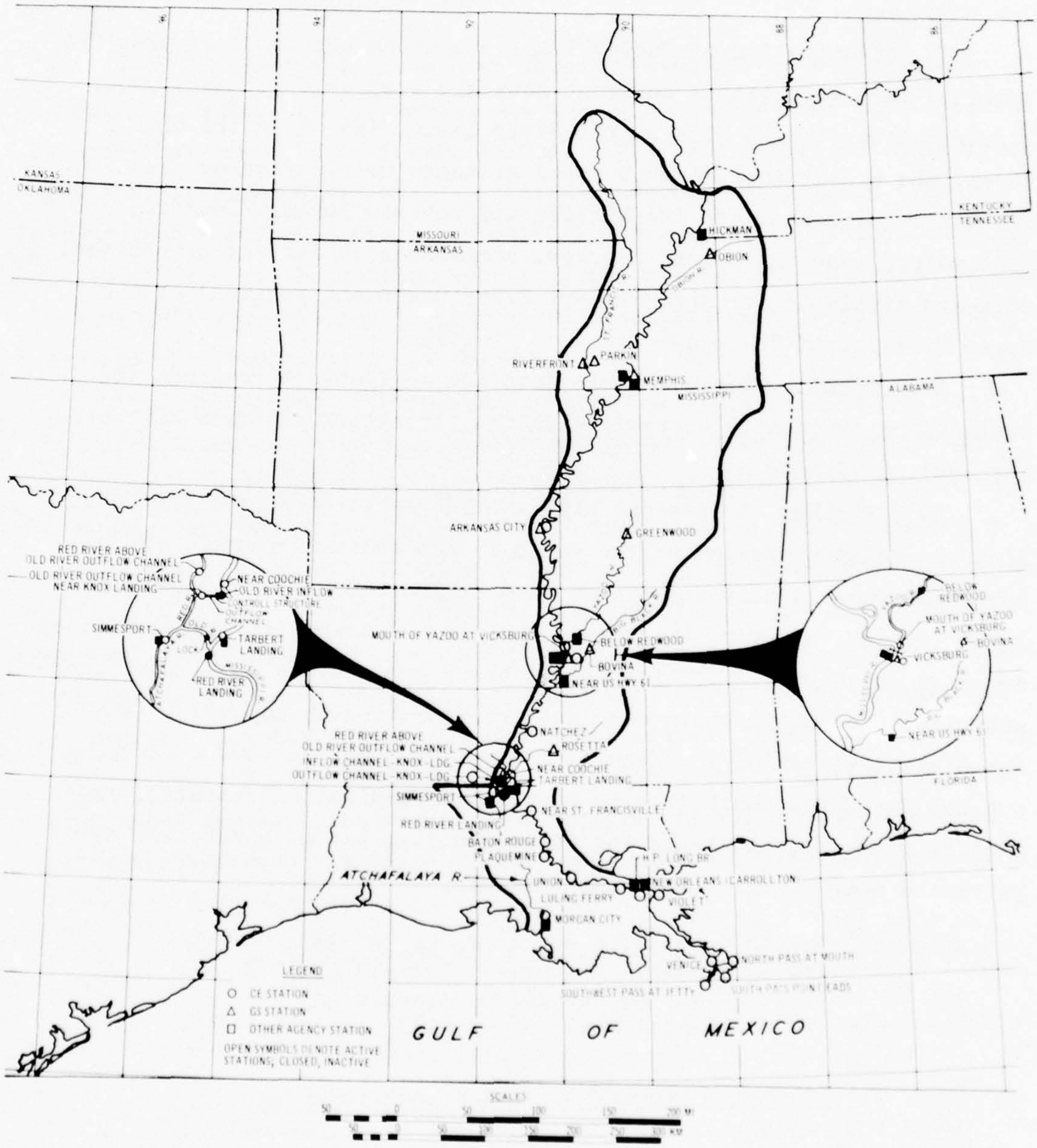

Figure 6. Lower Mississippi Subbasin

much of the analyzed data is never reported, and much of the reported data is not readily accessible. On the other hand, at some stations more than one agency collects and analyzes samples and reports the resulting data.

37. Examination of Tables 1 and 3 and inspection of Figures 2-6 indicate that very little sediment data are available for many major stream reaches in the Mississippi River Basin, including the Ohio River, the Mississippi River between Arkansas City, Arkansas, and St. Louis, Missouri, and the Mississippi between Tarbert Landing, Mississippi, and the mouth; however, comprehensive records of sediment data are available for the Missouri River Basin and portions of the Upper Mississippi Valley.

38. Considerable discharge data are available throughout the basin which is readily accessible in the literature and from automated information systems.

39. Further discussions with knowledgeable personnel indicate that the sediment regime of the basin is not well understood. Models have been successfully structured to describe the sediment regime in local reaches; however, the models must be calibrated for these reaches and have questionable application in other reaches. A model that characterizes the entire basin sediment transport regime appears to have immediate application in planning activities directed toward carrying out the Corps responsibility in maintaining navigation channels, protecting property, and improving water quality; but much research has yet to be done to structure such a model.

PART IV: PREPARATION OF NARRATIVE SUMMARIES FOR SELECTED SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISSIPPI RIVER BASIN

Determination of Break Point Locations

40. Sediment data have been taken at each of the 433 stations identified in Part III; however, not all of these stations have sediment passing that significantly adds to the load of the lower-ordered streams of the Mississippi River Basin. A stream network was defined that reflects that portion of the basin network where the bulk of the sediment transport occurs. Narratives were prepared for selected stations in the network that were assumed to pass significant sediment loads with respect to the network sediment regime.

41. The stream network was developed as follows: Discussions with the CE engineers in the Ohio-Tennessee and Upper Mississippi Subbasins indicated that break point locations* can usually be defined on most major streams above which sediment transport is not considered to be significant compared with the sediment being transported by the stream below this point. Further conversations with the CE engineers in the Missouri and Arkansas-White-Red Subbasins indicated that sediment transport has been sharply reduced on the majority of the major streams in the Midwest by multipurpose dams (sediment traps). Based on this information, the following break points were defined for streams in the basin above which the sediment transport is either not significant compared with the downstream transport or the sediment transport is stopped or reduced by a structure:

a. The Ohio River above the confluence of the Big Sandy River. The major sources of sediment below this point are the channel bottom and caving banks. All of the downstream tributaries from this point are minor sediment contributors.

b. The Upper Mississippi at Winona, Minnesota. Examination of available sediment load data indicated that downstream from Winona, Minnesota, the Root, Wapsipinicon, Rock,

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* Hereafter referred to simply as a break point.

Cedar, Iowa, Skunk, Des Moines, and Illinois rivers contribute significant amounts of sediment to the load of the Mississippi River with respect to the local sediment regime.

c. The Missouri River at Gavins Point Dam, South Dakota. Examination of available sediment load data indicated that downstream from Gavins Point Dam there is significant contribution of sediment to the load of the Missouri River by the Floyd, Little Sioux, Boyer, Platte, Nishnabotna, Big Nemaha, Nodaway, and Kansas rivers, and tributaries of the Kansas River. The break points on the Kansas River tributaries are Perry Dam on the Delaware River, Tuttle Creek Dam on the Big Blue River, Milford Dam on the Republican River, Glen Edler Dam on the Solomon River, Wilson Dam on the Saline River, and Kanopolis Dam on the Smoky Hill River.

d. The Arkansas River at Dardanelle Dam. The major sources of sediment below this point are the channel bottom and caving banks. All of the downstream tributaries of the Arkansas from this point are minor sediment contributors.

e. The Red River below Denison Dam, Texas. The major sources of sediment below this point are the channel bottom and caving banks. All of the downstream tributaries of the Red from this point are minor sediment contributors.

The remainder of the stream network is then defined by the Lower Mississippi and Atchafalaya rivers and the Lower Old River. This network is shown in Figure 7.

Selection of Stations

42. Of the 433 stations identified in the inventory, 155 are located on segments of the stream network shown in Figure 7. In the interest of economy and in order to prepare narratives for only those stations whose data would best characterize the sediment transport regime of the Mississippi River Basin, the following guidelines were used to eliminate stations from the group of 155:

a. Stations at which only grab samples are taken were eliminated, e.g. Luling Ferry, Louisiana, where grab samples are taken from the Mississippi River at the ferry landing.

b. Where there was a choice of two or more stations, the

Figure 7. Stream network where bulk of sediment transport occurs

station having the longer, more reliable period of record was selected, e.g. at Vicksburg, Mississippi, there are records available for four stations. Two of these are closed Environmental Protection Agency (EPA) stations having only 2-year periods of record; another is a USGS station at which a single vertical sample has been taken monthly since 1973. The last station is a CE station at which multiple samples have been taken weekly since 1968. The CE and USGS stations were selected for this study; the two EPA stations were deleted from consideration.

c. Selection of stations on tributaries of the major streams were handled on an individual basis. Generally, all stations other than the one farthest downstream in the watershed were eliminated because only the sediment contribution of the tributary to the next lowest-order stream was of interest. For example, on the Rock River there are four sediment stations; only the station at Joslin (nearest the confluence of the Rock and Mississippi rivers) was selected for this study. However, conversations with knowledgeable CE and USGS personnel indicated that in some cases more than one station on a tributary should be selected in order that the contribution of sediment to the next lower-ordered stream could be accurately monitored, e.g., the Cedar River joins the Iowa River immediately above its confluence with the Mississippi River. There is no sediment station on the reach of the Iowa River between its confluence with the Cedar and its confluence with the Mississippi; hence, stations at both Iowa City and Cedar Rapids were needed to monitor the sediment discharge of the Iowa into the Mississippi.

43. Thus, 81 stations were eliminated from the 155, leaving 74 stations that are well distributed areally over the portion of the basin defined by the break points (Figure 8). Most of the 74 stations have records of reliable sample collection techniques, sample laboratory analysis, and reduction and reporting of the resulting data. Of the selected stations, some have short records but are anticipated to be longer term stations (paragraph 28). Seventeen of the stations have been recently closed, but the station data are valid because the regional sediment regime has not changed significantly in the vicinity of these stations.

Figure 8. Locations of sediment sample collection stations for which narratives were prepared

Station Narratives

44. Detailed narratives were prepared for the 74 selected stations (Appendix A). The information presented for each station is arranged in the following general format:

River Name and Location

Station identification
Site description
Station chronological record
Sample and data collection procedures
Laboratory sample analysis
Data reduction procedures
Data reporting procedures
General information

Station identification

45. The station identification portion of the narrative includes the OWDC number and agency station number assigned to each station; also, the latitude and longitude,* the agency reporting to the OWDC, and the river mile of each station as established by the most recent survey.

Site description

46. The site description includes information on the reach of the stream and the region in the vicinity of the station, i.e. topography, type of bank protection used, bed gradient, typical bed-load composition, land use, navigation in the stream, soil loss upstream, hydraulic and commercial structures in the stream, tributaries to the stream, channel alignment, etc. Also included are maximum, mean, and minimum values for the discharge and sediment load passing the station.

Station chronological record

47. The station chronological record is a historical description of the agency(s) responsible for collecting and analyzing the sediment samples as well as reducing and reporting the resulting data.

Sample and data collection procedures

48. The sample and data collection procedures section describes the methods used to collect the samples (grab, single vertical, range),

* See paragraph 29.

the type and number of samples taken (point, point-integrated, depth-integrated), the frequency of collection, and the apparatus used for collection and transportation of the samples to the laboratory for analysis. If a stream-gaging station is located at or near the site of the sediment sample collection station, detailed information is provided on the period of record and type of apparatus used to measure stage. In most cases the period of record of the stream-gaging station predates the record of the sediment station; however, the entire period of record is included not only for historical purposes but also in the event that it is desired to predict sediment load from stages for the period prior to the record of the sediment station.

Laboratory sample analysis

49. The laboratory sample analysis section includes a detailed description of how the samples are analyzed or a reference describing the laboratory procedure. The resulting data (i.e. concentration, sediment load, suspended or bed particle-size distribution, etc.) are discussed.

Data reduction procedures

50. The data reduction procedures portion of the narrative describes the methods used to transform the results of the laboratory analysis into a form suitable for reporting. Equations or computer programs used in the data reduction effort are documented.

Data reporting procedures

51. The data reporting procedures section describes all sources from which a potential user of the data can obtain the desired information. The sources include published documents, as well as automated information systems containing published and unpublished data. Two systems are currently on-line, STORET (EPA) and WATSTORE (OWDC). References 22 and 23 contain instructions for accessing these systems. Another system is currently being assembled (Kansas City District) for available sediment data on the Missouri River but will not be on-line until 1978.

General information

52. The general information portion of the narrative includes

an agency address from which additional information can be obtained. Also presented are comments on the quality of the sediment data records and any other information pertinent to the station.

Reference material

53. The sources used to assemble the information required to prepare the narratives in Appendix A are listed at the end of the appendix. Of the 64 references included at the end of the main text, the first 23 are cited in the report and the remaining 41 are generally relevant to sediment transport and deposition in the Mississippi River Basin. These 41 references are also cited as appropriate in Appendix A.

PART V: CONCLUSIONS AND RECOMMENDATIONS

Conclusions

49. The following conclusions have resulted from this study:

a. The inventory presented in Part III and the narratives in Appendix A have updated the information in previous WES papers.[1,2]

b. Very little sediment data are available for many major stream reaches in the Mississippi River Basin, including the Ohio River, the Mississippi River between Arkansas City, Arkansas, and St. Louis, Missouri, and the Mississippi between Tarbert Landing, Mississippi, and the mouth. Comprehensive records of sediment data are available for the Missouri River Basin and portions of the Upper Mississippi Valley. Considerable discharge data are available for most of the Mississippi River Basin (paragraphs 37 and 38).

c. There is wide variation among and within agencies relevant to the methods used to collect and analyze sediment samples as well as the procedures used to reduce and report the resulting data (paragraphs 35 and 36).

Recommendations

50. Based on the findings of this study, it is recommended that:

a. Sediment sample collection stations be established on reaches of major streams of the Mississippi River Basin where there are currently no active stations.

b. After sediment data have been reduced by an agency, they be either published or maintained on file in a format such that they are easily accessible by other agencies.

c. Sediment sample collection programs be coordinated among agencies such that duplicate efforts are eliminated.

d. Agencies responsible for the operation of sediment sample collection and stream-gaging stations attempt to maintain accurate histories of the sediment collection program including equipment used, sampling procedures, and personnel involved.

e. A study be conducted to characterize the transport and deposition of sediment in the major streams of the Mississippi River Basin. The results of such an effort

will provide the basis for development of procedures for assessment of sediment control methods, and for evaluating problems resulting from sedimentation, such as reduction in the design life of flood control reservoirs, deposition in navigation channels, degradation of public, industrial, and agricultural water-supply quality, etc.

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Table 1

Sediment Sample Collection Stations on the Major Streams in the Mississippi River Basin

Arkansas River

River Mile	WRR	CE District	Station: OWDC Number	Station: Agency Number	Station: Name	Latitude	Longitude	Type of Water Body Sampled	Period of Record*	Interrupted Record	Type of Sample Collected: Suspended Sediment Concentration	Type of Sample Collected: Suspended Sediment Particle-Size Distribution	Type of Sample Collected: Bed Material Particle-Size Distribution	Type of Sample Collected: Other	Method Used to Collect Sediment Samples	Agency Reporting to OWDC
13.4	08	V	54926	040000	Yancopin, Ark.	335720	911215	S	1965-67	-	-	**	-	-	R	EPA
141.5	11	LR	54647	07263500	Little Rock, Ark.	344458	921618	S	1969	-	5	**	-	-	R	CE
219.5	11	LR	54624	07258000	Dardanelle, Ark.	351334	930858	S	1972	-	8	**	-	-	R	CE
258.0	11	LR	54635	07252405	Ozark, Ark.	352902	934956	S	1930	x	5	**	-	-	R	CE
308.9	11	LR	54634	07250500	Van Buren, Ark.	352542	942137	S	1944	-	3	**	-	-	R	CE
395.4	11	T	54708	07246500	Sallisaw, Okla.	352050	944616	S	1943-72	-	4	-	-	-	R	CE
395.5	11	T	54709	07194500	Muskogee, Okla.	354610	951755	S	1943-71	-	**	-	-	-	R	CE
466.7	11	T	67984	07165600	Tullahasse, Okla	354815	952410	S	1969-74	-	5	-	-	-	R	CE
483.7	11	T	82644	07165570	Haskell, Okla.	354923	953839	S	1974	-	-	-	-	7	G	GS
523.7	11	T	54707	07164500	Tulsa, Okla.	360837	960013	S	1930	-	4	-	-	-	R	CE
538.8	11	T	51837	07164400	Sand Springs Br., Okla.	360648	960649	S	1946	-	-	-	-	7	R	GS(N)
594.0	11	T	51832	07152500	Ralston, Okla.	363009	964322	S	1944	x	-	-	-	7	R	GS
701.4	11	T	56922	07146500	Arkansas City, Kans.	370323	970332	S	1961	-	3	6	7	-	R	GS(N)
701.4	11	T	50285	07146500	Arkansas City, Kans.	370330	970324	S	1951	-	3	8	-	-	R	GS
749.5	11	T	50277	07144550	Derby, Kans.	373224	971631	S	1961-74	-	5	-	-	-	G	GS
800.3	11	T	50275	07143330	Hutchinson, Kans.	375647	974629	S	1959	-	**	**	**	-	R	GS
873.2	11	A	50271	07141300	Great Bend, Kans.	382111	984550	S	1944	-	5	6	7	-	R	GS
920.3	11	A	50269	07140000	Kinsley, Kans.	375533	992231	S	1958	-	3	5	6	-	R	GS
970.2	11	A	50268	07139500	Dodge City, Kans.	374451	1000108	S	1958	-	5	7	7	-	R	GS(N)
1024.2	11	A	50328	07139000	Garden City, Kans.	375721	10000237	S	1961-68	-	**	**	**	-	R	GS
1080.9	11	A	50349	07138000	Syracuse, Kans.	375758	1014523	S	1958	-	5	6	7	-	R	GS
1097.9	11	A	04224	07137500	Coolidge, Kans.	380134	1020047	S	1975	-	5	5	-	-	R	GS(N)
1157.7	11	A	51259	07130500	BL John Martin Res., Colo.	380502	1025510	S	1974	-	5	5	-	-	V	CE
1176.6	11	A	65904	07140000	Las Animas, Colo.	380508	1031250	S	1959	-	5	5	-	-	R	CE
1289.8	11	A	51257	07099400	Pueblo, Colo.	381617	1044306	S	1965-70	-	5	5	-	-	R	GS
1316.8	11	A	51255	07099200	Portland, Colo.	382014	1045618	S	1964	-	5	6	7	-	R	GS
1331.2	11	A	51256	07096000	Canon City, Colo.	382602	1051524	S	1963	x	5	7	-	-	R	GS
1340.5	11	A	76260	07094500	Parkdale, Colo.	382914	1052225	S	1967-69	-	**	**	-	-	R	GS

(Continued)

Note: x = During the period of record, the collection of samples was suspended one or more times for an interval of one year or more.
(N) = National Stream Quality Accounting Network Station (NASQUAN).
* Years standing alone, e.g. 1939, indicate beginning of period of record; period continues to present.
** Measurement was either discontinued or the frequency was not reported.

Table 1. (Continued)

Atchafalaya River

River Mile	WRR	CE District	Station: OWDC Number	Station: Agency Number	Station: Name	Latitude	Longitude	Type of Water Body Sampled	Period of Record*	Interrupted Record	Types of Sample Collected: Suspended Sediment Concentration	Types of Sample Collected: Suspended Sediment Particle-Size Distribution	Types of Sample Collected: Bed Material Particle-Size Distribution	Types of Sample Collected: Other	Method Used to Collect Sediment Samples	Agency Reporting to OWDC
5.6	08	NO	54927	210120	Simmesport, La.	305800	914830	S	1965-67	-	-	**	-	-	R	EPA
8.2	08	NO	54776	03045	Simmesport, La.	305857	914754	S	1952	-	4	4	4	-	R	CE
117.7	08	NO	54928	210131	Morgan City, La.	294145	911230	S	1965-67	-	-	**	-	-	R	EPA
117.8	08	NO	54758	03780	Morgan City, La.	294140	911239	S	1946	x	3	2	2	-	R	CE

(Continued)

Note: x = During the period of record, the collection of samples was suspended one or more times for an interval of one year or more.
* Years standing alone, e.g. 1951, indicate beginning of period of record; period continues to present.
** Measurement was either discontinued or the frequency was not reported.

Table 1. (Continued)

Kansas River

River Mile	WRR	CE District	Station: OWDC Number	Station: Agency Number	Station: Name	Latitude	Longitude	Type of Water Body Sampled	Period of Record*	Interrupted Record	Types of Sample Collected: Suspended Sediment Concentration	Types of Sample Collected: Suspended Sediment Particle-Size Distribution	Types of Sample Collected: Bed Material Particle-Size Distribution	Types of Sample Collected: Other	Method Used to Collect Sediment Samples	Agency Reporting to OWDC
31.0	10	KC	50262	06892500	Bonner Springs/DeSoto, Kans.	385900	945752	S	1949	-	**	**	-	-	R	GS
31.0	10	KC	54653	156	Bonner Springs/DeSoto, Kans.	385900	945752	S	1948	-	8	8	8	-	R	CE
63.8	10	KC	50259	06891000	Lecompton, Kans.	390307	952315	S	1974	x	8	-	5	-	R	CE
126.9	10	KC	50255	06887500	Wamego, Kans.	391152	961816	S	1957	-	5	9	9	-	R	GS

(Continued)

Note: x = During the period of record, the collection of samples was suspended one or more times for an interval of one year or more.
* Years standing alone, e.g. 1949, indicate beginning of period of record; period continues to present.
** Measurement was either discontinued or the frequency was not reported.

Table 1. (Continued)

Mississippi River

River Mile	WRR	CE District	Station: OWDC Number	Station: Agency Number	Station: Name	Latitude	Longitude	Type of Water Body Sampled	Period of Record*	Interrupted Record	Types of Sample Collected: Suspended Sediment Concentration	Suspended Sediment Particle-Size Distribution	Bed Material Particle-Size Distribution	Other	Method Used to Collect Sediment Samples	Agency Reporting to OWDC
-11.8	08	NO	16887	01850	South Pass at Point Eads, La.	290053	890957	E	1975	-	9	-	-	-	G	CE
-14.0	08	NO	N	01900	North Pass at Mouth, La.	291221	890206	E	1975	-	9	-	-	-	G	CE
-19.2	08	NO	16886	01670	Southwest Pass at Jetty, La.	285442	892530	E	1975	-	9	-	-	-	G	CE
10.7	08	NO	16879	01480	Venice, La.	291633	892110	S	1973	-	5	-	-	5	G	CE
82.7	08	NO	N	01385	Violet, La.	295252	895402	S	1974	-	5	-	-	5	G	CE
106.1	08	NO	54908	210001	H. P. Long Bridge, La.	295645	901010	S	1965-67	-	**	-	-	-	R	EPA
106.2	08	NO	54910	210020A	New Orleans, La.	295635	901010	S	1965-67	-	-	**	-	-	R	EPA
106.2	08	NO	73760	01300	New Orleans (Carrolton), La.	295605	900810	S	1973, 1975	-	5	9	9	5	R	CE
120.7	08	NO	N	01290	Luling Ferry, La.	295619	902149	S	1957	-	5	-	-	5	G	CE
167.4	08	NO	N	01222	Union, La.	300552	905445	S	1973	-	5	-	-	5	G	CE
208.6	08	NO	N	01170	Plaquemine, La.	301700	911321	S	1973	-	5	-	-	5	G	CE
233.8	08	NO	N	01160	Baton Rouge, La.	303025	911155	S	1949-58, 1975, 1976	x	9	9	-	-	R	CE
266.0	08	NO	N	01139	Near St. Francisville, La.	304530	912345	S	1954	-	5	-	-	5	G	CE
301.7	08	NO	69364	01120	Red River Landing, La.	305739	913952	S	1958-1963	x	4	4	4	-	R	CE
306.2	08	NO	54912	210137	Tarbert Landing, La.	310020	913730	S	1965-67	-	-	**	-	-	R	EPA
306.3	08	NO	54880	01100	Tarbert Landing, Miss.	310030	913725	S	1963	-	4	4	4	-	R	CE
317.2	08	NO	54881	01020	Near Coochie, La.	310552	913612	S	1962-73, 1975	x	8	8	8	-	R	CE
362.3	08	V	N	N	Natchez, Miss.	313251	912544	S	1972	-	4	-	4	-	R	CE
435.2	08	V	54913	277000A	Vicksburg, Miss.	321830	905430	S	1965-67	-	**	**	-	-	R	EPA
435.2	08	V	54907	277000	Vicksburg, Miss.	321830	905430	S	1965-67	-	**	**	-	-	R	EPA
435.4	08	V	85494	07289000	Vicksburg, Miss.	321827	905421	S	1973	-	5	-	-	-	V	GS(N)
435.4	08	V	N	N	Vicksburg, Miss.	321827	905421	S	1968	-	4	-	4	-	R	CE
554.1	08	V	91649	07265450	Arkansas City, Ark.	333400	911500	S	1974	-	4	-	-	-	R	GS(N)
565.9	08	V	N	N	Arkansas City, Ark.	333836	911107	S	1967	-	4	-	4	-	R	CE
734.8	08	M	85492	0703200	Memphis, Tenn.	350737	900425	S	1973	-	5	-	-	-	R	GS(N)
735.2	08	M	54915	470020	Memphis, Tenn.	350500	900415	S	1965-67	-	**	**	-	-	R	EPA
920.5	08	M	54916	202803	Hickman, Ky.	363445	891400	S	1965-67	-	**	**	-	-	R	EPA
43.7	07	SL	74804	07022000	Thebes, Ill.	371300	892750	S	1974	-	5	-	-	-	R	GS
179.1	07	SL	51870	07010000	St. Louis, Mo.	383744	901047	S	1948	-	4	9	9	-	R	GS
199.7	07	SL	93045	05587550	Below Alton, Ill.	385606	900815	S	1975	-	5	5	-	-	R	GS

(Continued)

Note: N = None.
x = During the period of record, the collection of samples was suspended one or more times for an interval of one year or more.
(N) = National Stream Quality Accounting Network Station (NASQUAN).
* Years standing alone, e.g. 1975, indicate beginning of period of record; period continues to present.
** Measurement was either discontinued or the frequency was not reported.

(Sheet 4 of 9)

Table 1. (Continued)

Mississippi River

River Mile	WRR	CE District	Station OWDC Number	Station Agency Number	Station Name	Latitude	Longitude	Type of Water Body Sampled	Period of Record	Interrupted Record	Types of Sample Collected: Suspended Sediment Concentration	Suspended Sediment Particle-Size Distribution	Bed Material Particle-Size Distribution	Other	Method Used to Collect Sediment Samples	Agency Reporting to OWDC
309.2	07	RI	54604	N	Hannibal, Mo.	394324	912149	S	1943	-	3	8	-	-	V	CE
326.1	07	RI	65299	K39	Quincy, Ill.	395600	912500	S	1968-72	-	-	-	-	-	-	IDPH
363.9	07	RI	54614	N	Keokuk, Iowa	402335	912225	S	1943	-	3	8	-	-	V	CE
363.9	07	RI	75685	05474500	Keokuk, Iowa	402335	912225	S	1974	-	5	5	-	-	R	GS(N)
403.1	07	RI	54603	N	Burlington, Iowa	404753	910539	S	1942	-	3	8	-	-	V	CE
511.8	07	RI	84372	05420500	Clinton, Iowa	414653	901504	S	1974	-	5	5	-	-	R	GS(N)
579.9	07	RI	54612	N	East Dubuque, Ill.	422950	903850	S	1942	-	3	8	-	-	V	CE
634.8	07	SP	84732	05389500	McGregor, Iowa	430129	911021	S	1975, 1976	x	8	8	8	-	R	GS
672.7	07	SP	70306	NO-5	Victory, Wis.	432803	911311	S	1966	-	-	-	-	8	-	DPC
679.2	07	SP	70305	NO-3	Genoa, Wis., Dam 8	433407	911342	S	1966	-	-	-	-	8	-	DPC
683.1	07	SP	70308	NO-4	Thief SL Boat Landing, Wis.	433317	911400	S	1966	-	-	-	-	8	-	DPC
685.7	07	SP	70307	NO-2	Stoddard, Wis.	433710	911323	S	1966	-	-	-	-	8	-	DPC
701.7	07	SP	70304	NO-1	LaCrosse, Wis.	434823	911530	S	1966	-	-	-	-	8	-	DPC
714.3	07	SP	57083	UM-7143	Lock & Dam No. 6, Minn.	440000	912625	S	1962	-	8	-	-	-	G	MPCA
725.7	07	SP	52749	05378500	Winona, Minn.	440320	913815	S	1974	-	5	-	-	-	R	GS(N)
752.0	07	SP	72882	UM-752	Lock & Dam No. 4, Minn.	441930	915121	S	1971	-	8	-	-	8	G	MPCA
760.2	07	SP	57084	UM760.2	Wabasha, Minn.	442226	920221	S	1967-68	-	8	-	-	8	G	MPCA
772.8	07	SP	68542	UM772.8	Lake City, Minn.	442710	921530	S	1968-71	-	8	-	-	8	G	MPCA
796.7	07	SP	69149	QOR-1	Lock & Dam No. 3, Minn.	443636	923636	S	1969	-	5	-	-	-	G	MWCA
797.0	07	SP	57085	UM-797	Lock & Dam No. 3, Minn.	443643	923645	S	1967-68	-	8	-	-	8	G	MPCA
814.0	07	SP	17658	71-3	Bl. Lock & Dam No. 2, Minn.	444448	925108	S	1972	-	5	-	-	5	R	GS
815.0	07	SP	57086	UM-815	Hastings, Minn.	444551	925153	S	1953	x	8	-	-	8	G	MPCA
839.0	07	SP	06209	05331000	St. Paul, Minn.	445640	930520	S	1974	-	5	-	-	-	R	GS(N)
841.0	07	SP	57088	UM-841	St. Paul, Minn.	445111	930122	S	1967	x	8	-	-	8	G	MPCA
859.0	07	SP	57087	UM-859	Minneapolis, Minn.	450250	931636	S	1967-71	-	8	-	-	8	G	MPCA
864.8	07	SP	52757	05288500	Near Anoka, Minn.	450736	931748	S	1975	-	3	8	8	-	G	GS
914.0	07	SP	57093	UM-914	Clearwater, Minn.	452509	940230	S	1967	-	8	-	-	8	G	MPCA
929.0	07	SP	57094	UM-929	St. Cloud, Minn.	453400	941055	S	1953	-	8	-	-	8	G	MPCA
953.0	07	SP	57095	UM-953	Royalton, Minn.	454432	942124	S	1967	-	8	-	-	8	G	MPCA
982.0	07	SP	57096	UM-982	Camp Ripley, Minn.	460430	942015	S	1967	-	8	-	-	8	G	MPCA
1029.0	07	SP	57097	UM-1029	Crosby, Minn.	463240	935709	S	1967-68	-	8	-	-	8	G	MPCA
1137.0	07	SP	57098	UM-1137	Jacobson, Minn.	470007	931605	S	1967	-	8	-	-	8	G	MPCA
1186.0	07	SP	57099	UM-1186	Cohasset, Minn.	471347	934530	S	1967	-	8	-	-	8	G	MPCA

(Continued)

Note: N = None.
x = During the period of record, the collection of samples was suspended one or more times for an interval of one year or more.
(N) = National Stream Quality Accounting Network Station (NASQUAN).

Table 1. (Continued)

Missouri River

River Mile	WRR	CE District	Station			Latitude	Longitude	Type of Water Body Sampled	Period of Record*	Interrupted Record	Types of Sample Collected				Method Used to Collect Sediment Samples	Agency Reporting to OWDC
			OWDC Number	Agency Number	Name						Suspended Sediment Concentration	Suspended Sediment Particle-Size Distribution	Bed Material Particle-Size Distribution	Other		
97.9	07	KC	66939	06934500	Hermann, Mo.	384236	912621	S	1969	–	5	–	–	–	R	GS(N)
97.9	07	KC	54659	11	Hermann, Mo.	384236	912621	S	1948	–	4	5	5	**	R	CE
336.4	10	KC	73503	06894100	Sibley, Mo.	391046	941103	S	1972	–	5	–	–	–	G	MPSC
365.5	10	KC	54661	39	Kansas City, Mo.	390643	943516	S	1948	–	4	5	5	**	R	CE
447.8	10	KC	54662	44	St. Joseph, Mo.	394510	945128	S	1948	–	4	5	5	**	R	CE
448.2	10	KC	66928	06818000	St. Joseph, Mo.	394814	945234	S	1974	–	5	–	–	–	R	GS(N)
561.8	10	O	54736	951	Nebraska City, Nebr.	404055	955048	S	1957-72	–	8	–	9	–	R	CE
561.8	10	O	50381	06807000	Nebraska City, Nebr.	404055	955048	S	1951	–	8	–	5	–	R	GS(N)
615.9	10	O	54735	801	Omaha, Nebr.	411532	955520	S	1939-72	–	8	–	9	–	R	CE
615.9	10	O	67331	06610000	Omaha, Nebr.	411532	955520	S	1969	–	8	–	5	–	R	GS
732.3	10	O	75469	06486000	Sioux City, Iowa	422910	962447	S	1971	–	8	–	5	–	R	GS(N)
732.3	10	O	54734	701	Sioux City, Iowa	422910	962445	S	1954-72	–	8	–	9	–	R	CE
805.8	10	O	54733	621	Yankton, S. Dak.	425158	972337	S	1939-69	–	8	–	9	–	R	CE
879.8	10	O	84072	06453000	Bl. Ft. Randall Dam, S. Dak.	430354	983311	S	1974	–	5	–	–	–	G	GS(N)
1012.8	10	O	54726	531	Chamberlain, S. Dak.	434745	992110	SR	1957-59	–	5	–	5	**	R	CE
1066.5	10	O	82195	06440000	Pierre, S. Dak.	442225	1002220	S	1951	–	5	–	–	–	G	GS(N)
1314.5	10	O	66051	06342500	Bismarck, N. Dak.	464851	1004912	S	1972	–	3	5	5	–	R	GS
1314.5	10	O	54732	321	Bismarck, N. Dak.	464851	1004912	S	1946-73	–	**	**	–	**	G	CE
1389.9	10	O	54719	370002	Garrison Dam, N. Dak.	473010	1012550	R	1953	–	4	–	–	–	G	CE
1389.9	10	O	73438	06338490	Garrison Dam, N. Dak.	473008	10112550	S	1971	–	–	–	–	5	G	GS
1620.8	10	O	54731	051	Culbertson, Mont.	480724	1042830	S	1949-73	x	**	**	–	**	R	CE
1620.8	10	O	51115	06185500	Culbertson, Mont.	480724	1042830	S	1965	–	3	5	5	–	R	GS(N)
1701.4	10	O	54730	041	Wolf Point, Mont.	480400	1053200	S	1948-70	–	5	5	–	–	R	CE
1763.5	10	O	N	06132000	Bl. Ft. Peck Dam, Mont.	480239	1062121	S	1974	–	5	–	–	–	R	GS(N)
1774.5	10	O	54724	293003	Ft. Peck Dam, Mont.	480042	1062536	R	1957	–	4	–	–	–	G	CE
1921.6	10	O	74327	06115200	Landusky, Mont.	473751	1084113	S	1972	–	3	5	5	–	R	GS
1938.1	10	O	54728	293007	Power Plant Ferry, Mont.	473751	1085605	S	1948-72	–	6	6	–	6	R	CE
2032.6	10	O	54729	007	Virgelle, Mont.	480014	1101519	S	1962-69	–	5	5	–	**	R	CE
2032.6	10	O	03364	0610500	Virgelle, Mont.	480014	1101519	S	1969	–	5	–	–	–	R	GS(N)
2242.8	10	O	63062	06058502	Bl. Canyon Ferry Dam, Mont.	463858	1114339	S	1967	–	5	–	–	–	V	BR
2289.6	10	O	74322	0654500	Toston, Mont.	460846	1112518	S	1949	–	**	–	–	–	R	GS(N)

Note: N = None.
x = During the period of record, the collection of samples was suspended one or more times for an interval of one year or more.
(N) = National Stream Quality Accounting Network Station (NASQUAN).
* Years standing alone, e.g. 1963, indicate beginning of period of record; period continues to present.
** Measurement was eith er discontinued or the frequency was not reported.

Table 1. (Continued)

Ohio River

River Mile	WRR	CE District	Station			Latitude	Longitude	Type of Water Body Sampled	Period of Record*	Interrupted Record	Types of Sample Collected				Method Used to Collect Sediment Samples	Agency Reporting to OWDC
			OWDC Number	Agency Number	Name						Suspended Sediment Concentration	Suspended Sediment Particle-Size Distribution	Bed Material Particle-Size Distribution	Other		
35.0	05	P	62265	-	Shippingport, Pa.	403710	802620	S	1957	-	-	-	-	6	-	ERDA
341.1	05	H	83933	03216600	Greenup Dam, Ky.	383848	825138	S	1974	-	5	5	-	-	R	GS(N)
531.5	05	L	50161	03277200	Markland Dam, Ky.	384629	845752	S	1974	-	5	5	-	-	R	GS(N)
720.7	05	L	83948	03303280	Cannelton Dam, Ky.	375358	864220	S	1974	-	5	5	-	-	R	GS(N)
962.2	05	L	56671	03612500	Dam 53, Near Grand Chain, Ill.	371211	890230	S	1973	-	5	5	-	-	R	GS(N)

(Continued)

Note: N = None
(N) = National Stream Quality Accounting Network Station.(NASQUAN).
* Years standing alone, e.g. 1957, indicate beginning of period of record; period continues to present.

Table 1. (Continued)

Old River Outflow Channel

River Mile	WRR	CE District	Station			Latitude	Longitude	Type of Water Body Sampled	Period of Record*	Interrupted Record	Types of Sample Collected				Method Used to Collect Sediment Samples	Agency Reporting to OWDC
			OWDC Number	Agency Number	Name						Suspended Sediment Concentration	Suspended Sediment Particle-Size Distribution	Bed Material Particle-Size Distribution	Other		
	08	NO	54779	02050	Inflow Channel-Knox-Ldg., La.	310440	0913549	C	1961-74	-	5	5	5	-	R	CE
	08	NO	54778	02600	Outflow Channel-Knox-Ldg., La.	310355	0914125	C	1963	-	8	8	8	-	R	CE

(Continued)

* Years standing alone, e.g. 1963, indicate beginning of period of record; period continues to present.

(Sheet 8 of 9)

Table 1. (Concluded)

Red River

River Mile	WRR	CE District	Station: OWDC Number	Station: Agency Number	Station: Name	Latitude	Longitude	Type of Water Body Sampled	Period of Record*	Interrupted Record	Types of Sample Collected: Suspended Sediment Concentration	Types of Sample Collected: Suspended Sediment Particle-Size Distribution	Types of Sample Collected: Bed Material Particle-Size Distribution	Types of Sample Collected: Other	Method Used to Collect Sediment Samples	Agency Reporting to OWDC
13.1	08	NO	54884	04800	Above Old River Outflow Ch, La.	310408	914245	S	1963	-	8	8	8	-	R	CE
74.0	08	NO	N	04675	Moncla, La.	311206	920827	S	1972	-	5	-	-	-	G	CE
104.9	08	NO	54883	04600	Alexandria, La.	311846	922634	S	1952	-	8	8	8	-	R	CE
135.0	08	NO	N	04525	Boyce, La.	312337	924004	S	1972	-	5	-	-	-	G	CE
140.0	08	NO	86725	04450	Colfax, La.	313058	924313	S	1972	-	3	-	-	-	G	CE
242.4	11	NO	N	07350500	Coushatta, La.	320045	932410	S	1969-74	-	5	-	-	-	G	EPA
277.6	11	NO	54882	04225	Shreveport, La.	323055	934425	S	1966	-	4	-	4	-	R	CE
282.6	11	NO	N	07344410	Above Shreveport, La.	323257	934551	S	1974	-	8	-	-	8	G	GS(N)
318.2	11	NO	N	04200	Hosston, La.	325335	934920	S	1957	-	6	-	-	-	G	CE
401.8	11	NO	54777	04075	Fulton, Ark.	333626	934856	S	1966	x	4	-	4	-	R	CE
556.9	11	T	70810	07336820	Dekalb, Tex.	334115	944139	S	1969	-	3	-	-	-	G	TWDB
633.1	11	T	17332	07335500	Arthur City, Tex.	335232	953008	S	1938	-	9	9	-	-	R	CE
722.6	11	T	N	N	Colbert, Okla.	334904	963120	S	1930-60	-	9	-	-	-	R	GS
725.5	11	T	52765	07335600	Denison, Tex.	334908	963347	S	1944	-	5	5	-	-	G	GS
791.5	11	T	56851	07316000	Gainesville, Tex.	334340	970935	S	1936	-	5	-	-	-	R	CE
872.0	11	T	N	07315500	Terral, Okla.	335250	975615	S	1967-74	-	5	-	-	-	G	GS
933.0	11	T	67366	07308500	Burkburnett, Tex.	340630	983200	S	1968	-	5	5	-	-	G	GS(N)
1145.0	11	T	63326	07297910	Wayside, Tex.	345015	1012449	S	1967	-	5	5	-	-	G	GS

Note: N = None.
x = During the period of record, the collection of samples was suspended one or more times for an interval of one year or more.
(N) = National Stream Quality Accounting Network Station. (NASQUAN).
* Years standing alone, e.g. 1963, indicate beginning of period of record; period continues to present.

Table 2

Notation for Table 1

CE Districts	Type of Water Body Sampled
A - Albuquerque	C - Canal
H - Huntington	E - Estuarine zone
KC - Kansas City	R - Reservoir
L - Louisville	S - Stream
LR - Little Rock	
M - Memphis	
NO - New Orleans	**Method Used to Collect Sediment Samples**
O - Omaha	
P - Pittsburgh	G - Grab sample
RI - Rock Island	R - Samples taken on multiple verticals
SL - St. Louis	V - Samples taken on single vertical
SP - St. Paul	
T - Tulsa	
V - Vicksburg	

Frequency of Sample Collection

1 - Continuous	5 - Monthly
2 - Seasonal	6 - Quarterly
3 - Daily	7 - Annually
4 - Weekly	8 - Other periodic
	9 - Irregularly
	** - Measurement was either discontinued or the frequency was not reported

Agency Reporting to Office of Water Data Coordination (OWDC)

- BR - U. S. Bureau of Reclamation
- CE - U. S. Army Corps of Engineers
- DPC - Dairyland Power Cooperative (Wisconsin)
- EPA - Environmental Protection Agency
- ERDA - Energy Research and Development Agency
- GS - U. S. Geological Survey
- IDPH - Illinois Department of Public Health
- MPCA - Minnesota Pollution Control Agency
- MPSC - Missouri Public Service Commission
- MWCC - Metropolitan Waste Control Commission (Minneapolis)
- TWDB - Texas Water Development Board

Note: For latitude and longitude convention, see paragraph 29.

Table 3

Tabulation of Sediment Sample Collection Stations on Minor Streams in the Mississippi River Basin

River	CE District*	OWDC Number	Station Name**	Period of Record	Agency Reporting to OWDC
Allegheny	P	84367	New Kensington, Pa.	1972	GS(N)
	P	69997	Eldred, Pa.	1970	GS
Bad	O	84040	Ft. Pierre, S. Dak.	1946	GS
	O	54746	Ft. Pierre, S. Dak.	1947-1973	CE
Beaver	P	70035	Wampum, Pa.	1970	GS
Big Black	V	54923	Near U. S. Hwy 61, Miss.	1965-1967	EPA
	V	82190	Bovina, Miss.	1972	GS(N)
Big Blue	KC	50254	Near Manhattan, Kans.	1974	GS(N)
	KC	54657	Bl Tuttle Creek Dam, Kans.	1960-1972	CE
	KC	54676	Barnes, Kans.	1959-1971	CE
	KC	50253	Barnes, Kans.	1961	GS
	KC	50390	Deweese, Nebr.	1955-1969	GS
	KC	54658	Barneston, Nebr.	1959-1972	CE
	KC	54660	Crete, Nebr.	1964-1970	CE
	KC	67309	Crete, Nebr.	1961	GS
	KC	67966	Dorchester, Nebr.	1967	CE
	KC	50388	Dorchester, Nebr.	1963	GS
	KC	50386	Suprise, Nebr.	1965	GS
Big Nemaha	KC	54674	Falls City, Nebr.	1949-1967	CE
	KC	74228	Humbolt, Nebr.	1971	CE
	KC	74226	Humbolt, Nebr.	1971	CE
Big Sandy	H	50156	Louisa, Ky.	1949	GS(N)
Big Sioux	O	56371	Akron, Iowa	1974	GS(N)
	O	66045	Dell Rapids, S. Dak.	1960	GS
	O	56374	Brookings, S. Dak.	1960-1974	GS
	O	81512	Watertown, S. Dak.	1972	GS
Blackwater	KC	69307	Blue Lick, Mo.	1970	CE
Black (Wis.)	SP	51219	Galesville, Wis.	1954	GS
	SP	51218	Neilsville, Wis.	1954	GS
Boyer	O	52035	Logan, Iowa	1964-1973	GS
	O	86832	Denison, Iowa	1968-1974	CE
	O	86831	Deloit, Iowa	1969-1974	CE
Canadian	T	54703	Whitfield, Okla.	1938	CE
	T	56928	Whitfield, Okla.	1944	GS(N)
	T	51854	Calvin, Okla.	1965	GS(N)
	T	54704	Calvin, Okla.	1905	CE
	T	67941	Bridgeport, Okla.	1948	GS
	T	63324	Canadian, Tex.	1967	GS
	T	68057	N. Mex./Tex. state line	1969	GS
	T	52535	Taylor Springs, N. Mex.	1966	GS
Cannonball	O	73442	Brelen, N. Dak.	1945	GS(N)
	O	54742	Brelen, N. Dak.	1948	CE
	O	73323	Bentley, N. Dak.	1946	GS
	O	50546	Regent, N. Dak.	1964	GS
Cedar	RI	73595	Cedar Rapids, Iowa	1943-1954	GS
	RI	63310	Austin, Minn.	1961	GS
Chariton	KC	67958	Mussel Fork, Mo.	1969	CE
	KC	54675	Huntsville, Mo.	1963-1970	CE

(Continued)

Note: (N) denotes National Stream Quality Accounting Network (NASQUAN).
* See Table 2 for District abbreviations.
** Stations are listed in order of increasing river mileage from mouth.

Table 3 (Continued)

River	CE District	OWDC Number	Station Name	Period of Record	Agency Reporting to OWDC
Chariton (cont'd)	KC	67959	Rathbun Dam, Iowa	1969	CE
	KC	52031	Rathbun, Iowa	1962	GS
	KC	67614	Chariton, Iowa	1969-1973	GS
	KC	75613	Promise City, Iowa	1965-1973	GS
	KC	67960	Promise City, Iowa	1969	CE
Cheyenne	O	82138	Eagle Butte, S. Dak.	1945-1967	GS
	O	84039	Cherry Creek, S. Dak.	1969	GS(N)
	O	54745	Cherry Creek, S. Dak.	1968-1973	CE
	O	82194	Plainview, S. Dak.	1967-1969	GS
	O	66841	Bl Angostura Dam, S. Dak.	1951	GS
	O	50551	Hot Springs, S. Dak.	1946-1968	GS
	O	67137	Spencer, Wyo.	1951	GS
Chippewa	SP	86842	Durand, Wis.	1974	CE
	SP	51211	Bruce, Wis.	1954	GS
Cimarron	T	51835	Perkins, Okla.	1952	GS(N)
	T	63131	Buffalo, Okla.	1959	GS(N)
	T	50352	Mocane, Okla.	1962-1967	GS
	T	81715	Forgan, Okla.	1966	GS
	T	50348	Liberal, Kans.	1961	GS
	T	77058	Ulysses, Kans.	1962	GS
Cumberland	N	50190	Grand Rivers, Ky.	1966	GS(N)
	N	76826	Carthage, Tenn.	1965	GS(N)
	N	50187	Williamsburg, Ky.	1951-1973	GS
Delaware (Kans.)	KC	67967	Bl Perry Dam, Kans.	1969	CE
Des Moines	RI	63487	St. Francisville, Mo.	1974	GS(N)
	RI	54605	Tracy, Iowa	1940	CE
	RI	73610	Des Moines, Iowa	1944-1973	GS
	RI	56920	Saylorville, Iowa	1961	GS
	RI	54613	Boone, Iowa	1940	CE
	RI	70191	Boone Co., Iowa	1962	ERD
	RI	65984	Stratford, Iowa	1968	CE
	RI	57060	Ceylon, Minn.	1967	MPC
	RI	57062	Petersburg, Minn.	1953	MPC
	RI	63311	Jackson, Minn.	1967	GS
	RI	57061	Dovray, Minn.	1967-1968	MPC
Floyd	O	67621	James, Iowa	1968-1973	GS
Fourche Le Fave	LR	54643	Gravelly, Ark.	1939	CE
Grand	O	66833	Little Eagle, S. Dak.	1956	GS(N)
	O	54753	Little Eagle, S. Dak.	1962	CE
	O	50555	Shadehill, S. Dak.	1946-1968	GS
	O	75181	Haley, N. Dak.	1950	GS
	O	54743	Haley, N. Dak.	1962	CE
Green	L	83934	Beech Grove, Ky.	1974	GS(N)
	L	50169	Munfordville, Ky.	1949	GS
Heart	O	73441	Mandan, N. Dak.	1949	GS
	O	54741	Mandan, N. Dak.	1948-1973	CE
Homochitto	V	69425	Rosetta, Miss.	1969-1971	GS(N)
Illinois	SL	85491	Valley City, Ill.	1975	GS(N)
	RI	08955	Marseilles, Ill.	1975	GS(N)
Iowa	RI	52045	Iowa City, Iowa	1943	GS
	RI	54615	Marengo, Iowa	1957	CE
	RI	54609	Marshalltown, Iowa	1944-1967	CE
	RI	52048	Rowan, Iowa	1957	GS
James (S. Dak.)	O	50549	Scotland, S. Dak.	1974	GS(N)

(Continued)

Note: (N) denotes National Stream Quality Accounting Network (NASQUAN).

Table 3 (Continued)

River	CE District	OWDC Number	Station Name	Period of Record	Agency Reporting to OWDC
Jefferson	O	74312	Silver Star, Mont.	1972	GS
	O	51097	Twin Bridges, Mont.	1957-1972	GS
Kentucky	L	81734	Lock 2, Lockport, Ky.	1973	GS(N)
	L	50163	Frankfort, Ky.	1906	GS
Kickapoo	SP	51227	Steuben, Wis.	1954	GS
	SP	74568	Gays Mills, Wis.	1964	GS
	SP	73128	La Farge, Wis.	1954	GS
	SP	73124	Rockton, Wis.	1971	GS
	SP	81454	Ontario, Wis.	1972	GS
Knife	O	73439	Hazen, N. Dak.	1946	GS(N)
	O	54740	Hazen, N. Dak.	1948-1969	CE
	O	73309	Golden Valley, N. Dak.	1945	GS
Licking	L	80366	Butler, Ky.	1949	GS(N)
	L	50159	McKinneysburg, Ky.	1952-1973	GS
	L	50158	Farmers, Ky.	1949	GS
Little Arkansas	T	50276	Valley Center, Kans.	1944	GS
Little Kanawha	H	64167	Grantsville, W. Va.	1968	GS
Little Miami	L	50832	Milford, Ohio	1965	GS(N)
	L	67104	Marathon, Ohio	1969-1974	GS
Little Missouri	O	73437	Watford City, N. Dak.	1946	GS(N)
	O	54739	Watford City, N. Dak.	1948	CE
	O	73306	Medora, N. Dak.	1946	GS
	O	73436	Marmarth, N. Dak.	1945	GS
Little Sioux	O	54748	Turin, Iowa	1943-1969	CE
	O	73425	Correctionville, Iowa	1950-1962	GS
Miami	L	86111	New Baltimore, Ohio	1961	GS(N)
	L	50846	Troy, Ohio	1965-1974	GS
	L	50842	Sidney, Ohio	1965	GS
Milk	O	54737	Nashua, Mont.	1969	CE
Minnesota	SP	57103	Shakopee, Minn.	1960-1971	MPC
	SP	52750	Jordon, Minn.	1974	GS(N)
	SP	57104	Le Sueur, Minn.	1953	MPC
	SP	72879	St. Peter, Minn.	1971	MPC
	SP	52751	Mankato, Minn.	1960	GS
	SP	57109	Courtland, Minn.	1953	MPC
	SP	63301	New Ulm, Minn.	1967	GS
	SP	57111	Morton, Minn,	1967	MPC
	SP	57116	Milan, Minn.	1967	MPC
Monongahela	P	53958	Braddock, Pa.	1958	GS(N)
Moreau	O	54744	Whitehorse, S. Dak.	1959	CE
	O	66828	Whitehorse, S. Dak.	1959	GS
Muskingum	H	50776	McConnelsville, Ohio	1950	GS(N)
	H	50772	Dresden, Ohio	1952-1974	GS
Neosho	T	51849	Ft. Gibson, Okla.	1951	GS(N)
	T	51847	Commerce, Okla.	1947	GS
Ninnescah	T	50284	Peck, Kans.	1958	GS
	T	50280	Murdock, Kans.	1960	GS
	T	50337	Pratt, Kans.	1962	GS
	T	50279	Cheney, Kans.	1960-1967	GS
	T	50278	A B Cheney Res., Kans.	1965	GS
Niobrara	O	54754	Verdel, Nebr.	1961	CE
	O	50367	Verdel, Nebr.	1958	GS(N)
	O	50366	Norden, Nebr.	1950	GS

(Continued)

Note: (N) denotes National Stream Quality Accounting Network (NASQUAN).

Table 3 (Continued)

River	CE District	OWDC Number	Station Name	Period of Record	Agency Reporting to OWDC
Nishnabotna	O	06760	Hamburg, Iowa	1939-1951	CE
	O	52032	Red Oak, Iowa	1962-1973	GS
	O	56921	Randolph, Iowa	1965-1973	GS
Nodaway	KC	63482	NR Burlington Junction, Mo.	1969	CE
North Canadian	T	54691	Wetumka, Okla.	1938	CE
	T	82645	Ft. Reno, Okla.	1974	GS
	T	56863	Canton, Okla.	1938	CE
	T	63116	Seiling, Okla.	1951	GS
	T	83746	Woodward, Okla.	1955	CE
	T	63115	Beaver, Okla.	1957	GS(N)
	T	63114	Guymon, Okla.	1951	GS(N)
Obion	M	76849	Obion, Tenn.	1965	GS(N)
Osage	KC	77983	Osceola, Mo.	1972	CE
	KC	74870	St. Thomas, Mo.	1950	GS(N)
Ouachita	V	60168	Columbia, La.	1974	GS(N)
	V	67126	Camden, Ark.	1974	GS(N)
	V	58061	Camden, Ark.	1936	ADH†
	V	58025	Arkadelphia, Ark.	1935	ADH
	V	58193	Malvern, Ark.	1935	ADH
	V	86737	Jones Mill, Ark.	1943	ADH
	V	86736	Magnet, Ark.	1971	ADH
Pawnee	AL	50270	Larned, Kans.	1958	GS
Platte (Mo.)	KC	67617	Diagonal, Iowa	1968-1973	GS
Platte (Nebr.)	O	54751	Louisville, Nebr.	1939	CE
	O	75973	South Bend, Nebr.	1970	GS
	O	73455	North Bend, Nebr.	1966	GS(N)
	O	56353	Schuyler, Nebr.	1966-1968	GS
	O	75220	Overton, Nebr.	1950	GS
	O	51244	Julesburg, Colo.	1974	GS(N)
	O	51238	Kersey, Colo.	1947	GS
	O	69096	Lisco, Nebr.	1970	GS(N)
	O	51058	Wyo./Nebr. state line	1965	GS
	O	67140	Lingle, Wyo.	1969	GS
	O	51055	Bl Guernsey Res., Wyo.	1947	GS
	O	56312	Orin, Wyo.	1966	GS
	O	63094	Bl Casper, Wyo.	1947	GS
	O	73507	Casper, Wyo.	1971	GS
	O	51073	Northgate, Colo.	1965	GS
Purgatoire	AL	65903	Las Animas, Colo.	1959	CE
Republican	KC	56831	Bl Milford Dam, Kans.	1967-1974	CE
	KC	81905	Clay Center, Kans.	1957	GS(N)
	KC	54684	Clay Center, Kans.	1948	CE
	KC	54685	Concordia, Kans.	1961-1968	CE
	KC	56378	Scandia, Kans.	1957-1971	GS
	KC	54686	Guide Rock, Nebr.	1961-1968	CE
	KC	54687	Bloomington, Nebr.	1942-1968	CE
	KC	54670	Orleans, Nebr.	1948-1970	CE
	KC	67315	Orleans, Nebr.	1947	GS
	KC	54671	Cambridge, Nebr.	1961-1967	CE
	KC	67316	Trenton, Nebr.	1946	GS
	KC	54672	Benkelman, Nebr.	1961-1967	CE
Rock	RI	59456	Joslin, Ill.	1974	GS(N)
	RI	51232	Afton, Wis.	1954	GS
	RI	51230	Mayville, Wis.	1964-1970	GS
	RI	67721	Waupun, Wis.	1968-1970	GS

(Continued)

Note: (N) denotes National Stream Quality Accounting Network (NASQUAN).

† ADH denotes Arkansas Department of Health.

Table 3 (Continued)

River	CE District	OWDC Number	Station Name	Period of Record	Agency Reporting to OWDC
Root	SP	57080	Houston Co., Minn.	1967	MPC
	SP	63308	Near Houston, Minn.	1968	GS
	SP	63307	Lanesboro, Minn.	1961-1971	GS
St. Croix	SP	57077	Hudson, Wis.	1967	MPC
	SP	72881	Taylors Falls, Minn.	1953	MPC
	SP	74540	St. Croix Falls, Wis.	1954	GS(N)
	SP	57078	Pine City, Minn.	1967-1971	MPC
	SP	57079	Danbury, Wis.	1953	MPC
	SP	51210	Danbury, Wis.	1954	GS
St. Francis	M	83638	Riverfront, Ark.	1955	GS(N)
	M	85493	Parkin, Ark.	1955	GS(N)
Saline (Kans.)	KC	50240	Tescott, Kans.	1959	GS
	KC	54683	Bl Wilson Dam, Kans.	1964-1974	CE
Saline	KC	54679	Russell, Kans.	1964-1970	CE
	KC	50237	Russell, Kans.	1946	GS
	KC	50236	Wakeeney, Kans.	1955-1966	GS
Salt	L	50165	Shepherdsville, Ky.	1949	GS
Scioto	H	50816	Higby, Ohio	1953-1974	GS(N)
Skunk	RI	73600	Augusta, Iowa	1975	GS
Smoky Hill	KC	50250	Enterprise, Kans.	1957	GS(N)
	KC	50243	New Cambria, Kans.	1962-1968	GS
	KC	54677	Bl Kanapolis Dam, Kans.	1947-1967	CE
	KC	54678	Ellsworth, Kans.	1942-1967	CE
	KC	50233	Ellsworth, Kans.	1949	GS
	KC	50232	Russell, Kans.	1941	GS
Solomon	KC	50249	Niles, Kans.	1957	GS
	KC	54681	Osborne, Kans.	1962-1968	CE
	KC	69595	Kirwin, Kans.	1945	GS
Tennessee	N	83778	Highway 60, Ky.	1973	GS
	N	83895	Pickwick Dam, Tenn,	1974	GS(N)
	N	87717	Waterloo, Ala.	1973	EPA
	N	74059	South Pittsburg, Tenn.	1950	GS(N)
	N	83894	Watts Bar, Tenn.	1974	GS(N)
Verdigris	T	73568	Newt Grahm L&D near Inola, Okla.	1971	GS(N)
	T	54714	Inola, Okla.	1944-1971	CE
	T	51846	Inola, Okla.	1947-1971	GS
	T	54717	Oologah, Okla.	1961	CE
	T	54715	Lenapah, Okla.	1940	CE
	T	54712	Altoona, Kans.	1940	CE
	T	54713	Coyville, Kans.	1940	CE
	T	54716	Madison, Kans.	1956	CE
Vermillion	O	56370	Wakonda, S. Dak	1960	GS
	O	76183	Chancellor, S. Dak.	1960-1967	GS
Wabash	L	68365	New Harmony, Ind.	1974	GS(N)
	L	51802	Lafayette, Ind.	1954	GS
	L	66876	Bluffton, Ind.	1968-1970	GS
	L	73047	Lin Grove, Ind.	1970	GS
Walnut	T	50290	Winfield, Kans.	1961	GS
Wapsipinicon	RI	54610	Dewitt, Iowa	1942	CE
		52049	Independence, Iowa	1965-1973	GS

(Continued)

Note: (N) denotes National Stream Quality Accounting Network (NASQUAN).

Table 3 (Concluded)

River	CE District	OWDC Number	Station Name	Period of Record	Agency Reporting to OWDC
White (Ark.)	M	54925	Benzal, Ark.	1965-1967	EPA
	M	51081	Clarendon, Ark.	1974	GS(N)
	LR	86734	Southeast White Co., Ark.	1972	ADH
	LR	54630	Newport, Ark.	1939	CE
White (S. Dak.)	O	66834	Oacoma, S. Dak.	1939	GS(N)
	O	54747	Reliance, S. Dak.	1939	CE
	O	66839	Kadoka, S. Dak.	1945-1970	GS
	O	50558	Rocky Ford, S. Dak.	1963-1967	GS
	O	50556	Slim Butte, S. Dak.	1963-1967	GS
Wisconsin	SP	51226	Muscoda, Wis.	1954	GS(N)
Yazoo	V	none	Mouth of Yazoo at Vicksburg, Miss.	1970	CE
	V	54924	Bl Redwood, Miss.	1965-1967	EPA
	V	62136	Greenwood, Miss.	1974	GS(N)
Yellowstone	O	51127	Sidney, Mont.	1948	GS
	O	54738	Sidney, Mont.	1937-1973	CE
	O	51122	Billings, Mont.	1974	GS(N)
Zumbro	SP	N0367	Kellog, Minn.	1975	GS
	SP	83903	Zumbro Falls, Minn.	1961	GS

Note: (N) denotes National Stream Quality Accounting Network (NASQUAN).
† ADH denotes Arkansas Department of Health.

APPENDIX A: NARRATIVES FOR SELECTED SEDIMENT SAMPLE COLLECTION STATIONS

1. Narratives for the selected sediment sample collection stations are presented herein in the following sequence: alphabetically by river name and for each river sequentially from the mouth of the river* in the upstream direction. All latitudes are north of the equator and all longitudes are west of the prime meridian (paragraph 29, main text). "CE" is the U. S. Army Corps of Engineers, and "USGS" is the U. S. Department of the Interior Geological Survey. A list of references that were sources for the narratives is also presented at the end of this appendix.

2. An index is provided below as an aid for locating narratives for the individual stations. Pertinent figures are at the end of each narrative.

* Except for the Ohio River, where river miles are numbered in the downstream direction; hence, the stations on the Ohio are presented sequentially in the downstream direction from the confluence of the Monogahela and Allegheny rivers which converge to form the Ohio River.

River	Station	Page
Red	Above Old River Outflow Channel, Louisiana	A337
	Alexandria, Louisiana	A341
	Shreveport, Louisiana	A345
	Fulton, Arkansas	A348
	Dekalb, Texas	A353
	Arthur City, Texas	A359
	Colbert, Oklahoma	A364
Republican	Below Milford Dam, Kansas	A368
Rock	Joslin, Illinois	A374
Root	Near Houston, Minnesota	A379
Saline	Tescott, Kansas	A385
	Below Wilson Dam, Kansas	A390
Skunk	Augusta, Iowa	A396
Smoky Hill	Enterprise, Kansas	A401
	New Cambria, Kansas	A407
	Below Kanopolis Dam, Kansas	A412
Solomon	Niles, Kansas	A418
Wapsipinicon	DeWitt, Iowa	A423

Arkansas River at Little Rock, Arkansas

Station identification

OWDC No.: 54647

Agency station No.: 07263500

Latitude/longitude: 344458/921610

Agency reporting to OWDC: CE

River mile: 141.5 (Mile 0 is at the confluence of the Arkansas and Mississippi rivers; mile 0 to mile 35.2 established by USGS in 1970 and upstream of mile 35.2 established by the CE in 1972.) Notes: River mile 141.5 is the location of both the downstream (or Main Street bridge) sampling station and the present USGS recording gage described under "Sample collection procedure." A different system of river miles is used for the McClellan-Kerr Arkansas River Navigation System charts that were used as source material.

Site description

There are two sampling stations at Little Rock: one at mile 141.5 (the Main Street Bridge) and one at mile 148.0 (Murray Lock and Dam) (Figure A1). The Main Street Bridge connects the cities of Little Rock and North Little Rock. In addition to the urban and industrial areas of Little Rock-North Little Rock, there are 12 utility crossings, 1 municipal automobile bridge, 1 railroad bridge, several commercial docks, and 1 recreational area (Burns Park) between Murray Dam and the Main Street Bridge. There are two tributaries, White Oak Bayou and Shillcutt Creek, entering the Arkansas River in the vicinity of Burns Park. Both the left and right banks are protected with riprap or dikes. A private levee and a Government levee protect portions of the right bank. The channel gradient for this reach of the Arkansas is 0.7 ft/mile. The discharges of record (September 1927 to the present) are: maximum - 536,000 cfs; mean - 41,040 cfs; and minimum - 850 cfs. Flow is regulated by many locks, dams, and reservoirs upstream on the Arkansas River and tributaries, especially in Oklahoma. Construction of Murray Dam in 1969

had little direct effect on flow, since there were already numerous control structures upstream. The sediment loads of record (October 1969 to the present) are: maximum - 1,430,000 tons/day; mean - 36,362 tons/day; and minimum - 37 tons/day.

Station chronological record

The sediment sample collection program was established at this location in October 1969 because a long-term gaging record beginning in 1927 was available and because Murray Lock and Dam is downstream from the principal tributaries of the Arkansas River. Discharges and sediment loads measured here are representative of the discharges and sediment loads to the mouth of the Arkansas River.

Sample collection is a cooperative effort of the CE Little Rock District (LRD) and the USGS Arkansas District. Sample laboratory analysis is handled by the CE Southwestern Division (SWD) Laboratory, Dallas, Texas. Discharges measured by the USGS personnel at the Murray Dam gaging station are used to compute sediment loads from a sediment load curve prepared for this reach. The USGS has made periodic measurements of chemical constituents at its Murray Dam gaging station since February 1974.

Sample and data collection procedures

Suspended-sediment samples are normally taken from a boat on the downstream side of Murray Lock and Dam; however, when stream velocities are too high, the sampling location is at the Main Street Bridge. The samples are collected by either the LRD or USGS personnel whenever discharges are measured (usually once weekly). Either a US D-43 or US D-49 sampler (described in Reference 1a) is used to obtain depth-integrated samples on five separate verticals across the river. In conjunction with sediment sample collection, the following supplementary data are also obtained:

a. River stage at beginning and end of measurements.

b. Water depth at each vertical.

c. Velocity at 0.2 and 0.8 of depth of each vertical.

d. Water-surface width.

e. Distance between verticals.

f. Water temperature.

Gaging in the vicinity of Little Rock began in October 1871. The present gage is located at the Main Street Bridge (mile 141.5). The period of discharge record is 1927 to the present. The tabulation below summarizes the gaging and recording devices used at Little Rock during the period of record, as well as their locations and the agencies responsible for collecting the data:

Period	Locality	Device Used
	CE	
October 1871-1879	Foot of Commerce Street	Staff gage
1879 - January 1961	Baring Cross Bridge	Staff gage followed by other non-recording gages
	U. S. Weather Bureau (now National Weather Service)	
21 April 1873 - 15 September 1927	Main Street Bridge (mile 141.5)	Staff gage
1 October 1931 - 30 September 1933	Main Street Bridge (mile 141.5)	Staff gage
? - present	Main Street Bridge (mile 141.5)	Telemark gage
	USGS	
16 September 1927 - 30 September 1931	Main Street Bridge (mile 141.5)	Staff gage (Weather Bureau gage)
1 October 1933 - 18 December 1933	Main Street Bridge (mile 141.5)	Staff gage (Weather Bureau gage)
19 December 1933 - present	Downstream from Main Street Bridge	Recording gage
? - present	Main Street Bridge (mile 141.5)	Staff gages
10 May 1970 - present	Murray Dam (mile 148.0)	Instrumentation at Murray Lock and Dam monitoring head, discharge, and gate openings

Laboratory sample analysis

Sample laboratory analysis is handled by the SWD Laboratory, Dallas, Texas. Procedures used to analyze the sediment samples are outlined in the following paragraphs.

Sediment concentration. Samples are arranged in order, assigned an SWD laboratory number, and logged on Form 629a (Figure A2). The resistivity of the sample in each bottle is measured and recorded on this form. Samples to be tested for particle-size distribution are removed, and the remainder are grouped into sets of 34 samples.

The laboratory sample numbers of the first set of 34 are entered in the first line of Form 562-C (Figure A3). The weight of each sample, with bottle stoppers removed, is recorded on the second line.

Filter paper circles are marked with the number of a respective bottle cap and folded. Two extra filter papers are prepared for each set of 34 samples. These are blanks for control purposes. All the folded filter papers are placed in weighing bottles, one per bottle, and the bottle cap numbers recorded on the fifth line.

The 36 bottles with their filter papers are placed in a 105°C oven overnight. The following day, caps are screwed on before the bottles are removed from the oven. After desiccator cooling each filter paper is weighed to the nearest milligram and recorded (seventh line).

Thirty-six 4-in. filter funnels are assembled on racks. The filter papers are placed in the funnels in the order of listing on Form 562-C; the corresponding weighing bottle and cap are kept with the funnel.

The samples are poured into the funnels, with distilled water used to wash the bottles. Equal quantities of distilled water are poured through the two blanks. Weights of emptied sample bottles are recorded on the third line of Form 562-C.

When filtration is complete, filter papers with retained sediments are returned to their respective weighing bottles and dried overnight in a forced-draft oven at 105°C, then subjected to 24 additional hr of drying in another oven at 105°C. After cooling in a desiccator, each

filter paper (and retained sediment) is weighed to the nearest milligram and the weight recorded on the sixth line of Form 562-C. The weight of the silt (eighth line) is then computed by subtracting the value in line seven from the value in line six. The used filter papers are removed from the bottles and retained for possible use in checking questionable results.

Sediment concentrations are computed to the nearest 0.0001 percent from the data on Form 562-C (Figure A3), with appropriate corrections as indicated by the results of the two control filters. Test results are then entered on Form 629a (Figure A2).

Gradation. The weight of each sample (consisting of 1-3 bottles) is recorded to the nearest gram on Form 599 (Figure A4). A 100-ml portion of clear water is decanted into a tared beaker and evaporated for determination of dissolved solids.

All clear water is aspirated and discarded, and the remaining material transferred to a graduated cylinder for determination of volume of sediment and remaining native water. Diluted to 250 ml with distilled water, the sample is dispersed in a drink mixer and washed through a No. 200 sieve. Retained material is oven-dried and sieved; the minus 200 fraction is transferred to a tared graduated cylinder and allowed to settle out. The clear water is then decanted (to further reduce the fraction of native water in the test specimen), and the cylinder with sample and unremoved water are weighed. The approximate weight of solids is calculated from the known weights and volumes.

(If the estimated weight of solids is between 2.5 and 5g, the sample is transferred to a 1000-ml graduate for the pipette test which follows. If the estimated weight is between 1 and 2.5 g, a 500-ml graduate is used; below 1 g, a 250-ml graduate. Samples larger than 5 g are split to obtain a test specimen of near 5 g.)

A specified volume of Calgon is added to each sample, which is then redispersed in a drink mixer and washed back into its graduate. Distilled water is used to bring the volume to the desired level.

Each sample is mixed for 1 min by turning its graduate end-for-end. Four 25-ml pipette withdrawals are made for determining percentages

KC 54675 Huntsville, Mo. 1963-1970 CE
(Continued)

Note: (N) denotes National Stream Quality Accounting Network (NASQUAN).
* See Table 2 for District abbreviations.
** Stations are listed in order of increasing river mileage from mouth.

(Sheet 1 of 6)

finer than specified sizes. Each withdrawal is placed in a separate tared 100-ml beaker, with the remaining material washed into a larger beaker. All five beakers are oven-dried and weighed to the nearest milligram. The weights are recorded on Form 599 (Figure A4), and the computations are accomplished as indicated. Particle-size distribution curves are plotted on Form 158 (Figure A5).

Data reduction procedures

A suspended-sediment rating curve showing the relation between suspended-sediment concentration and measured discharge is constructed. This relation is applied to the computed sediment load (converted to tons/day) and mean daily surface-water discharge at the Little Rock gage. Sediment loads are interpolated for the days on which only discharge, but not sediment, data are obtained.

Data reporting procedures

Daily values for mean discharge, mean suspended-sediment concentration, and mean suspended-sediment load are published annually for each water year in Reference 2. Figure A6 is an example of these data. Also published in Reference 2 are daily temperatures and periodic water-quality data. Mean daily discharge values are also published in Reference 3.

General information

Additional information on this station can be obtained from: U. S. Army Engineer District, Little Rock, P. O. Box 867, 700 West Capitol, Little Rock, Arkansas 72203.

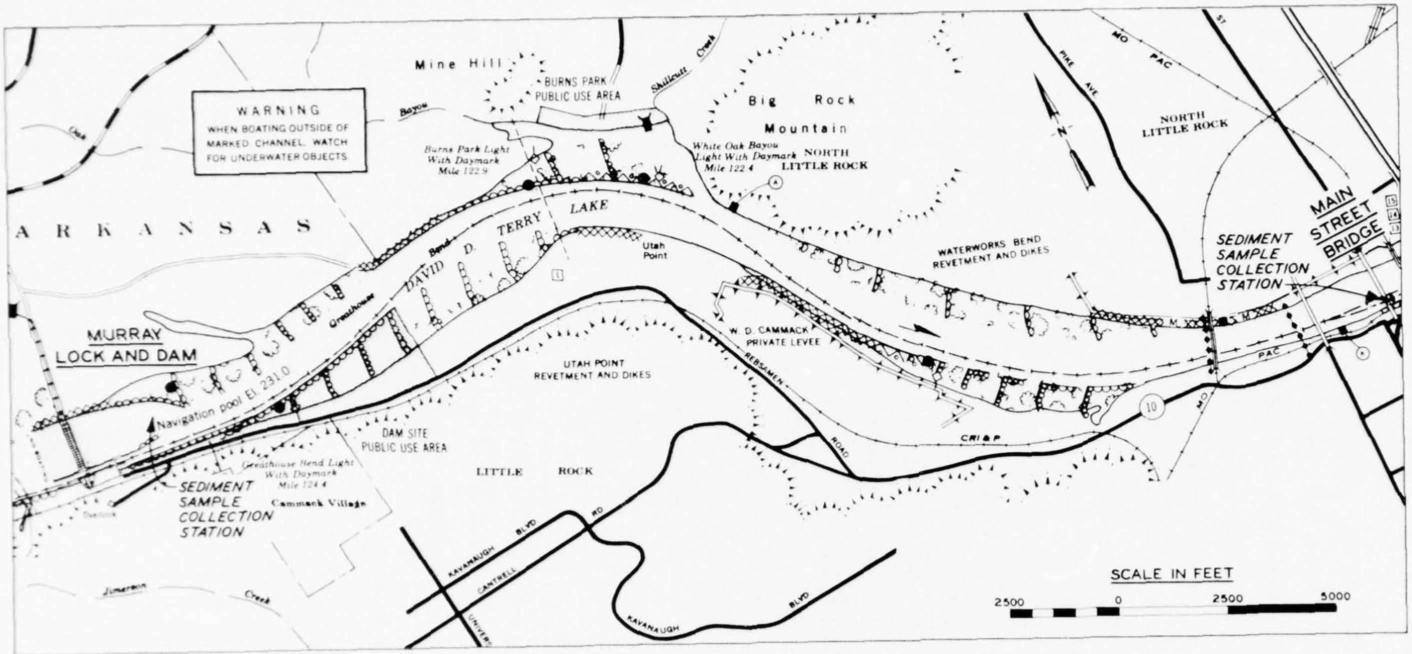


Figure A1. Site locations for Little Rock, Arkansas, sediment sample collection stations (Source: charts Nos. 47 and 48, Navigation Charts, McClellan-Kerr Arkansas River Navigation Systems, U. S. Army Engineer Districts, Little Rock and Tulsa, Little Rock, Arkansas, and Tulsa, Oklahoma, May 1974)

RIVER: ARKANSAS						SEDIMENT SAMPLES				SWDED-GL REPORT: 102			
GAGING STATION: LITTLE ROCK										DISTRICT: LR			
FIELD SAMPLE NO.	SWD LAB NO.	SAMPLING DATA									TEST RESULTS		
		DATE SAMPLED	TIME SAMPLED	RIVER STAGE	OBSERVER	TYPE SAMPLER	STATION	SAMPLE DEPTH	SOUNDER DEPTH	REMARKS	PERCENT SEDIMENT	RESIS-TIVITY OHM-CM	DISSOLVED SOLIDS PPM
1 of 3	A196	4 Mar 75	0900	16.21	SMITH	DI	31	11.0	11.0		.021	3050	
2 of 3	A200	"	"	"	"	"	51	15.5	15.5		.021	3100	
3 of 3	A219	"	"	"	"	"	72	18.7	18.7		.021	3250	

SWD FORM 629a
Rev 18 Sep 72

Figure A2. SWD Form 629a used for logging sediment samples and assigning SWD Laboratory numbers and sample data

SWD FORM 562-C REV 1 JUNE 53	SILT DETERMINATION								CORPS OF ENGINEERS SWD LABORATORY			
SAMPLE NO.	A196											
WT. BOTTLE & SAMPLE	622.9											
WT. BOTTLE	373.0											
WT. SAMPLE	249.9											
FILTER PAPER NO.	137											
WT. PAPER & SILT	128.532											
WT. PAPER	128.492											
WT. SILT	0.040											
% SILT (PPM)	0.160 (160)											
SAMPLE NO.												
WT. BOTTLE & SAMPLE												
WT. BOTTLE												
WT. SAMPLE												
FILTER PAPER NO.												
WT. PAPER & SILT												
WT. PAPER												
WT. SILT												
% SILT												
SAMPLE NO.												
WT. BOTTLE & SAMPLE												
WT. BOTTLE												
WT. SAMPLE												
FILTER PAPER NO.												
WT PAPER & SILT												
WT. PAPER												
WT. SILT												
% SILT												

DATE TESTED 1 Apr 1975 TECHNICIAN ______

Figure A3. Sediment analysis data form (SWD Form 562-C) with sample data

SWD FORM 599
24 JUNE 1957

SWD LABORATORY
MECHANICAL ANALYSIS DATA
SEDIMENT SAMPLES

Date Tested 1 Apr 1975 Sample No. A196

ORIGINAL SAMPLE

(A) Wt. Sample & Container 815 gm

(B) Wt. Container 367 gm

(C) Wt. Sample (Water, Sed.& Salt) 448 gm

(J) Vol. River Water & Sediment in graduate 80.0 cc

(K) Vol. Sediment = (M) ÷ 2.7 0.345 cc

(O) Vol. River Water in graduate 79.655 cc

DISSOLVED SALT DETERMINATION

(D) Beaker

(E) Vol. River Water cc

(F) Wt. Beaker & Salt 98.184 gm

(G) Wt. Beaker 98.151 gm

(H) Wt. Salt 0.033 gm

(I) Wt. Salt per cc River Water 0.00033 gm

PIPETTE ANALYSIS

Clock Time	(M) Elapsed Time	(O) Fall cm	(P) Beaker No.	(Q) Wt. Beaker	(R) Wt. Beaker, Salt & Sediment	(S) Wt. Salt & Sediment	(T) Wt. Sediment	(U) % Finer	(V) D,mm
	1½ Min.	17.2	9	47.582	47.644	0.062	0.062	54.5	.0430
	6 "	14.5	10	48.673	48.719	0.046	0.046	40.4	.0197
	30 "	11.8	11	47.332	47.359	0.047	0.037	32.5	.0079
	2 Hr	9.1	12	54.836	54.865	0.029	[illegible]	25.5	.0035
Remaining Suspension			#3	147.020	147.778	0.758	0.756	XXX	XXX

250 ml Cyl

(M) Total Wt. Sediment, gm 0.932

Dilution $86-\left(\frac{1555}{241.5} \times 8.0\right) = 2.849$ ml of native $H_2O = 1.1\%$

Total Salt = (2849) x (0.00033) = 0.00094/25 cc

Wt. Salt in each beaker, (S)-(T), = $\frac{(I)\times(L)\times \text{Vol. Evap., gm}}{250}$ % Finer, (U), = $\frac{(T)\times 1000}{(M)}$

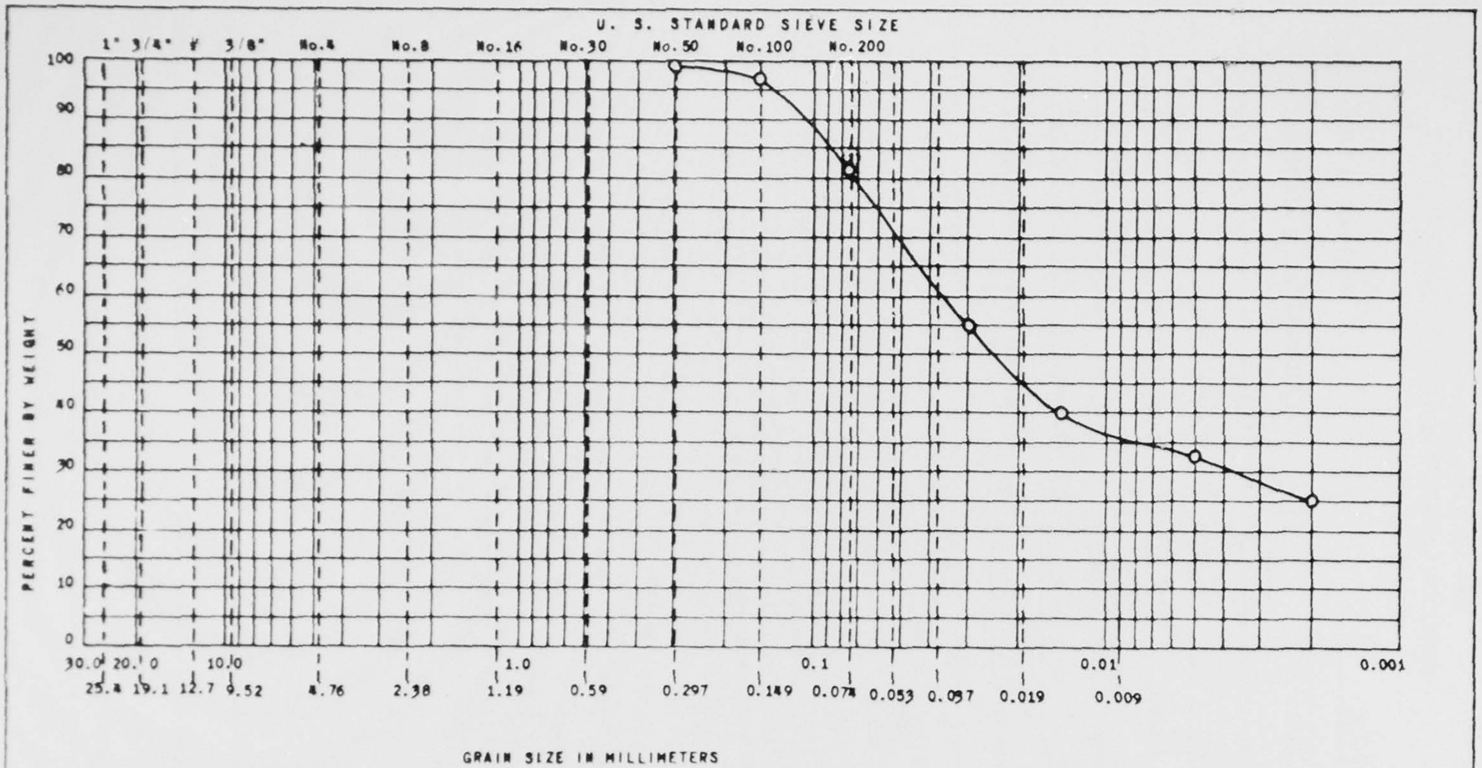
SIEVE ANALYSIS

Sieve Size	(W) Wt. Ret.	(X) % Ret. (W ÷ (M))x100	% Pass.
50	0	0	100
100	0.016	0.8	99
200	0.206	18	82

Sediment Concentration of Orig. Sample = $\frac{(M)\times 100}{(C)}$ = 0.254 % by Wt.

Soluble Salts Content = $(I)\times 10^6$ = 330 ppm

Figure A4. SWD Form 599 used for making computations for mechanical analysis and sample data



FIELD SAMPLE NUMBER	SWD LAB. NO.	DATE SAMPLED	TIME SAMPLED	RIVER STAGE	OBSERVER	STATION AT DEADWATER R.B.	STATION AT DEADWATER L.B.	STATION AT OBS.	SAMPLE DEPTH	SOUNDED DEPTH	DISSOLVED SOLIDS (PPM)	SEDIMENT PERCENT BY WEIGHT	DISTRICT LR
A-196											300	0.254	RIVER OR CREEK ARKANSAS
													STATION LITTLE ROCK
MECHANICAL ANALYSIS OF SEDIMENT SAMPLES													DATE 7 APRIL 1975

Figure A5. Sample particle-size distribution curve plotted on SWD Form 158

ARKANSAS RIVER BASIN

07263450 Arkansas River at Murray Dam, at Little Rock, Ark.

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	6560	10	177	71000	230	44025	62000	80	13372
2	3930	10	106	130000	520	182250	61900	80	13351
3	2230	10	60	161000	730	316860	60400	80	13027
4	1660	10	45	147000	640	253640	50600	60	8185
5	5900	10	159	126000	530	180040	42600	50	5742
6	8120	10	219	110000	430	127520	40100	50	5405
7	2410	10	65	136000	460	168660	36500	40	3936
8	4140	10	112	153000	460	189740	54200	60	8767
9	2410	10	65	124000	330	110320	61100	80	13178
10	3730	10	101	103000	210	58314	57600	70	10870
11	2850	10	77	91900	180	44597	47600	50	6416
12	5950	10	160	74300	130	26041	44600	50	6012
13	6480	10	175	67400	110	19988	46800	50	6309
14	2460	10	66	89200	170	40882	55800	60	9026
15	2870	10	77	103000	210	58314	57000	70	10757
16	4360	10	118	106000	220	62871	57000	70	10757
17	7120	10	192	106000	220	62871	59600	70	11248
18	8190	10	221	101000	210	57182	61600	80	13286
19	6790	10	183	106000	220	62871	45100	50	6079
20	6700	10	181	114000	250	76836	38100	50	5136
21	3940	10	106	106000	220	62871	44600	50	6012
22	2660	10	72	80600	150	32595	49600	50	6686
23	9810	10	264	77300	120	25008	49700	50	6700
24	26400	40	2847	76500	120	24749	45000	50	6066
25	29900	40	3224	83400	140	31478	48000	50	6470
26	26700	40	2879	89500	150	36194	36400	40	3925
27	31900	40	3440	87100	150	35223	31000	40	3343
28	38800	50	5230	83100	140	31365	38300	50	5163
29	29200	40	3149	75300	110	22331	26100	40	2815
30	25000	30	2022	62500	80	13480	32300	40	3483
31	44600	50	6012	--	--	--	43900	50	5918
TOTAL	361770	--	31804	3041100	--	2459116	1485100	--	237440

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	46500	50	6268	136000	370	135660	29200	80	6298
2	44400	50	5985	137000	370	136660	56800	110	16845
3	55200	60	8929	136000	370	135660	79600	170	36482
4	59500	70	11229	130000	350	122670	92400	200	49822
5	59200	70	11172	124000	320	106980	98300	220	58304
6	74400	110	22064	114000	290	89130	111000	260	77807
7	96000	170	43999	111000	280	83792	133000	330	118330
8	105000	200	56616	123000	320	106110	147000	360	142670
9	92800	160	40030	133000	350	125500	151000	380	154700
10	76100	120	24620	140000	370	139650	169000	430	195920
11	71000	100	19141	141000	380	144450	210000	540	305730
12	74200	110	22005	128000	330	113880	233000	600	376900
13	63200	80	13630	114000	290	89130	223000	570	342690
14	57800	70	10908	110000	280	83037	202000	520	283190
15	58200	70	10984	108000	270	78615	192000	490	253640
16	51500	60	8330	97100	230	60210	189000	490	249680
17	48100	50	6484	78900	170	36161	187000	480	241990
18	43000	50	5796	66600	140	25138	178000	450	215950
19	46800	50	6309	64100	130	22466	168000	420	190230
20	51500	60	8330	57500	120	18602	170000	420	192490
21	86900	140	32800	55200	110	16370	168000	420	190230
22	139000	320	119920	54000	110	16014	162000	400	174700
23	150000	350	141540	45300	100	12213	160000	390	168230
24	144000	350	135880	36700	90	8905	162000	400	174700
25	136000	330	121000	24500	80	5284	187000	470	236950
26	133000	320	114740	29500	80	6363	226000	580	353390
27	138000	350	130220	38100	90	9245	235000	620	392810
28	141000	370	140650	26500	80	5716	230000	630	390650
29	141000	370	140650	--	--	--	208000	580	325250
30	139000	370	138660	--	--	--	196000	570	301200
31	139000	380	142400	--	--	--	192000	570	295050
TOTAL	2760300	--	1701289	2559000	--	1933611	5145300	--	6512828

Figure A6. Example of sediment data for Little Rock, Arkansas (Source: Water Resource Data for Arkansas, 1974, USGS, Little Rock, Arkansas (sheet 1 of 2)

ARKANSAS RIVER BASIN

07263450 Arkansas River at Murray Dam, at Little Rock, Ark.--Continued

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCEN-TRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCEN-TRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCEN-TRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)
1	197000	610	323980	230000	430	266630	84100	60	13604
2	197000	620	329290	224000	420	253640	93600	90	22711
3	192000	620	320930	223000	420	252510	116000	150	46910
4	190000	630	322710	205000	390	223960	140000	230	86811
5	189000	610	310820	205000	370	204490	165000	310	137900
6	185000	590	294270	199000	350	187780	190000	380	194650
7	187000	580	292410	197000	350	185890	196000	390	206080
8	188000	560	283830	210000	380	215140	181000	360	175670
9	187000	550	277280	219000	400	236170	167000	340	153080
10	187000	530	267200	211000	380	216170	158000	350	149090
11	182000	510	250240	198000	350	186830	148000	340	135660
12	179000	480	231640	189000	330	168150	143000	320	123370
13	177000	460	219510	187000	320	161330	142000	320	122510
14	173000	440	205220	185000	320	159600	126000	270	91718
15	172000	420	194760	182000	310	152110	91700	160	39556
16	179000	430	207510	150000	180	72792	70000	100	18872
17	192000	450	232930	179000	250	120650	74000	110	21945
18	204000	460	252990	177000	220	104980	77100	120	24943
19	218000	490	287990	174000	190	89130	92900	160	40073
20	227000	500	306000	173000	170	79289	91300	160	39383
21	224000	480	289670	172000	150	69557	89200	150	36072
22	221000	460	274080	169000	120	54675	95600	170	43815
23	256000	530	365790	169000	140	63787	81800	130	28669
24	306000	610	503240	165000	150	66726	77600	120	25105
25	322000	630	546910	159000	150	64300	80500	130	28213
26	299000	570	459480	157000	180	76189	66400	90	16111
27	278000	530	397230	149000	170	68290	63700	80	13739
28	267000	510	367110	143000	170	65540	55100	60	8913
29	256000	490	338190	131000	160	56508	55000	60	8897
30	246000	470	311710	115000	130	40305	55500	60	8978
31	--	--	--	94900	90	23027	--	--	--
TOTAL	6476000	--	9265120	5578900	--	4186145	3267100	--	2063048

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCEN-TRATION (MG/L)	JULY SEDIMENT DISCHARGE (TONS/DAY)	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCEN-TRATION (MG/L)	AUGUST SEDIMENT DISCHARGE (TONS/DAY)	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCEN-TRATION (MG/L)	SEPTEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	56300	70	10625	20900	30	1690	11200	20	604
2	58700	70	11078	19500	30	1577	4230	10	114
3	50500	60	8169	20800	30	1682	3740	10	101
4	48800	50	6578	19700	30	1593	5600	10	151
5	32300	40	3483	19600	30	1585	6750	10	182
6	35800	40	3861	10800	20	582	17300	30	1399
7	38500	50	5190	11500	20	620	21600	30	1747
8	11100	20	599	8040	10	217	26700	40	2879
9	12100	20	652	8020	10	216	24500	30	1982
10	27600	40	2976	13700	20	739	17800	30	1440
11	25400	30	2054	5310	10	143	14600	20	787
12	32300	40	3483	17600	30	1423	16200	30	1310
13	22300	30	1804	15600	20	841	21200	30	1715
14	22300	30	1804	14400	20	776	20100	30	1626
15	22800	30	1844	16600	30	1343	12200	20	657
16	20300	30	1642	17100	30	1383	3460	10	93
17	30100	40	3246	15100	20	814	12300	20	663
18	25800	30	2087	14100	20	760	15100	20	814
19	20000	30	1618	9100	20	491	5380	10	145
20	21100	30	1707	6370	10	172	10700	20	577
21	22200	30	1796	13000	20	701	13500	20	728
22	25700	30	2079	14900	20	803	9440	20	509
23	20500	30	1658	15500	20	836	7070	10	191
24	22400	30	1812	8900	20	480	6820	10	184
25	22500	30	1820	16400	30	1326	12900	20	696
26	24900	30	2014	4920	10	133	17100	30	1383
27	19700	30	1593	6790	10	183	31400	40	3386
28	20500	30	1658	14800	20	798	42600	50	5742
29	19800	30	1601	16400	30	1326	49700	50	6700
30	21400	30	1731	15400	20	830	43900	50	5918
31	19400	30	1569	14100	20	760	--	--	--
TOTAL	853100	--	93831	424950	--	26823	504490	--	44423

Figure A6. (sheet 2 of 2)

Arkansas River at Dardanelle, Arkansas

Station identification

OWDC No.: 54624

Agency station No.: 07258000

Latitude/longitude: 351334/930858

Agency reporting to OWDC: CE

River mile: 219.5 (Mile 0 is at the confluence of the Arkansas and Mississippi rivers; mile 0 to mile 35.2 established by the USGS in 1970 and upstream of mile 35.2 established by the CE in 1972.) Notes: River mile 219.5 is the location of both the downstream (or Arkansas State Highway 7 Bridge) sampling station and the USGS river gage described under "Sample collection procedure." A different system of river miles is used for the McClellan-Kerr Arkansas River Navigation System charts that were used as source material.

Site description

There are two sampling stations at Dardanelle: one at mile 219.5 (Arkansas State Highway 7 Bridge) and one at mile 221.5 (Dardanelle Lock and Dam) (Figure A7). The gaging station is located on the highway bridge, which links the towns of Dardanelle and North Dardanelle. The city of Russellville is 2 miles north of the dam. The left bank of the river is protected with riprap and the right bank is protected by a series of transverse dikes. There is one high-voltage electrical line crossing the river midway between the dam and the bridge. Agriculture is practiced within the alluvial valley of the Arkansas River. The channel gradient through this reach of the river is 0.9 ft/mile. The discharges of record measured at the gaging station (July 1931 to the present) are: maximum - 683,000 cfs; mean - 35,980 cfs; and minimum - 43 cfs. Flow is regulated by many locks and dams upstream on the Arkansas River and its tributaries, especially in Oklahoma. Construction of Dardanelle Reservoir in 1964 had little direct effect on flow, since there were already numerous control structures upstream. The sediment

loads of record (October 1967 to the present) are: maximum - 1,120,000 tons/day; mean - 13,685 tons/ day; and minimum - 0 tons/day.

Station chronological record

The sediment sample collection stations were established in October 1967 to monitor sediment loads downstream from Dardanelle Lock and Dam, the farthest downstream high-head structure on the McClellan-Kerr Arkansas River Navigation System. Sample collection is a cooperative effort of the Arkansas Geological Commission (state agency), the CE Little Rock District (LRD) and the USGS Arkansas District. Sample laboratory analysis is handled by the CE Southwestern Division (SWD) Laboratory in Dallas, Texas. Data reduction and data publication are handled by the LRD. Discharge data are furnished by the USGS with data obtained from the gaging station.

The USGS has made periodic measurements of chemical constituents at its gaging station from October 1948 to September 1961, from August 1962 to August 1963, and from October 1972 to the present, and daily measurements of water temperature from October 1948 to September 1961 and from July 1971 to the present.

Sample and data
collection procedures

Information regarding the collection of sediment samples is identical to that presented for the Arkansas River sediment sample collection stations at Little Rock, Arkansas.

Gaging at Dardanelle (mile 219.5) began on 20 June 1886. The period of discharge record is July 1937 to the present. This gaging station is operated as a cooperative effort of the Arkansas Geological Commission (state agency), the LRD, and the USGS Arkansas District. The following tabulation lists the periods of record and locations of the gaging and recording devices used at Dardanelle by both the U. S. Weather Bureau (now National Weather Service) and the USGS:

Period	Locality	Device Used
	U. S. Weather Bureau (now National Weather Service)	
20 June 1886 - 30 April 1910	Ferry landing, left bank	Staff gage
1 May 1910 - 22 August 1934	Right bank at pontoon bridge cofferdams	Staff gage
	USGS	
22 August 1934 - 9 December 1970	Downstream handrail of highway bridge	Type A wire-weight gage
11 January 1939 - 17 February 1971	Downstream side of highway bridge	Water-stage recorder
10 December 1970 - present	Handrail on catwalk on side of pier of new bridge near left bank	Type A wire-weight gage
18 February 1971 - present	Upstream side of new bridge	Fisher-Porter automatic digital recorder driven by manometer

Laboratory sample analysis

Information is identical to that presented for the Arkansas River sediment sample collection stations at Little Rock, Arkansas.

Data reduction procedures

Information is identical to that presented for the Arkansas River sediment sample collection stations at Little Rock, Arkansas. Figure A8 is an example of published data for the Dardanelle stations.

General information

Additional information on this station can be obtained from: U. S. Army Engineer District, Little Rock, P. O. Box 867, 700 West Capitol, Little Rock, Arkansas 72203.

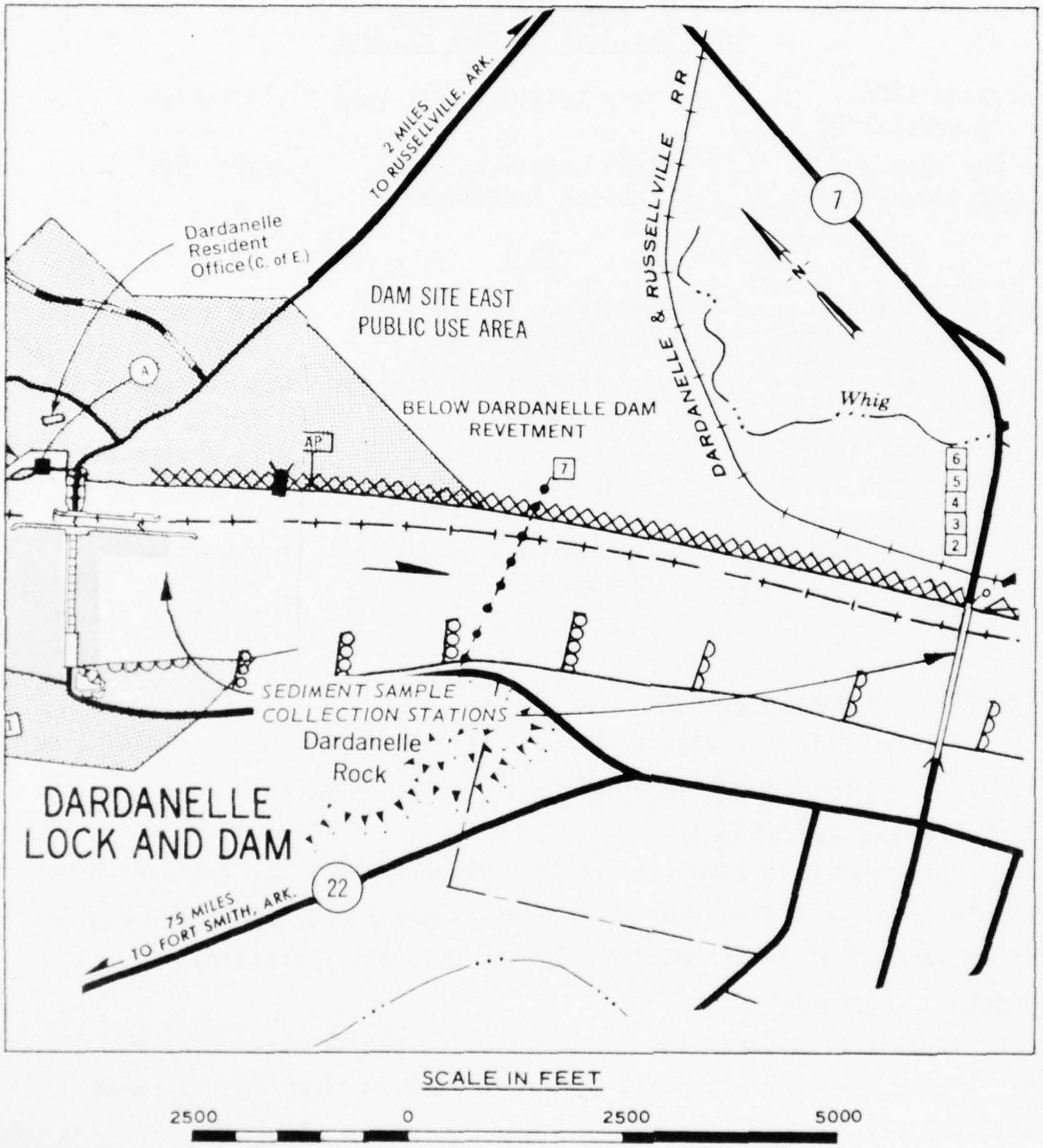


Figure A7. Site locations for Dardanelle, Arkansas, sediment sample collection stations (Source: Charts Nos. 36 and 37, Navigation Charts, McClellan-Kerr Arkansas River Navigation System, U. S. Army Engineer Districts, Little Rock and Tulsa, Little Rock, Arkansas, and Tulsa, Oklahoma, May 1974)

ARKANSAS RIVER BASIN

07258000 Arkansas River at Dardanelle, Ark.

REMARKS.--Records furnished by Corps of Engineers, Little Rock, Ark.

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	1310	10	35	104000	120	33646	51300	50	6915
2	2110	10	57	160000	180	77645	51700	50	6969
3	3150	10	85	133000	150	53785	46400	50	6255
4	3460	10	93	120000	140	45293	37600	40	4055
5	9150	10	247	94000	110	27877	33600	30	2718
6	7990	10	215	99600	110	29537	26200	20	1413
7	2340	10	63	141000	160	60822	32100	30	2596
8	370	10	10	112000	130	39254	42200	40	4551
9	4390	10	118	83400	90	20236	42300	40	4562
10	3130	10	84	82300	90	19969	29700	30	2402
11	5410	10	146	60200	70	11361	35600	40	3839
12	6830	10	184	48600	50	6551	24400	20	1316
12	8390	10	226	60400	70	11399	32100	30	2596
14	3040	10	82	96000	110	28470	37400	40	4033
15	570	10	15	96900	110	28737	37500	40	4044
16	6790	10	183	98700	110	29270	41500	40	4475
17	9760	10	263	88700	100	23914	44200	50	5958
18	8550	10	231	92000	100	24803	32600	30	2637
19	8370	10	226	107000	120	34617	21900	20	1181
20	5550	10	150	101000	110	29953	32100	30	2596
21	987	10	27	76500	80	16500	29700	30	2402
22	1320	10	36	62100	70	11720	38200	40	4119
23	19700	20	1062	61100	70	11531	31200	30	2523
24	28500	30	2305	72000	80	15529	38000	40	4098
25	27400	30	2216	81700	90	19824	29300	30	2370
26	30600	30	2475	80200	90	19460	25000	20	1348
27	35500	40	3828	76200	80	16435	28400	30	2297
28	34200	30	2766	67400	70	12720	23400	20	1262
29	16800	10	453	57400	60	9285	21200	20	1143
30	23500	20	1267	55000	60	8897	23300	20	1256
31	33900	30	2742	--	--	--	35600	40	3839
TOTAL	353067	--	21890	2668400	--	779040	1055700	--	101768

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	22400	20	1208	121000	140	45670	29500	30	2386
2	41700	40	4497	127000	140	47935	52300	60	8460
3	45100	50	6079	120000	130	45293	69500	80	14990
4	45200	50	6093	115000	120	40306	78200	90	18974
5	51800	50	6983	105000	120	33970	93400	110	27699
6	80900	90	19630	100000	110	29656	112000	130	39254
7	99900	110	29626	103000	120	33323	130000	150	52572
8	92300	100	24884	116000	130	40656	136000	160	58665
9	70200	80	15141	126000	140	47557	147000	170	67373
10	65000	70	12267	131000	150	52976	181000	210	102470
11	65300	70	12323	117000	130	41006	220000	260	154210
12	60800	70	11474	103000	120	33323	199000	230	123400
13	53800	60	8703	95700	110	28381	173000	200	93282
14	53000	60	8573	96300	110	28559	164000	190	84007
15	46100	50	6214	84500	90	20503	163000	190	83495
16	43000	40	4637	74200	80	16003	169000	200	91125
17	39800	40	4292	52200	60	8444	162000	190	82983
18	37100	40	4001	50400	50	6794	150000	170	68748
19	45300	50	6106	43700	40	4713	153000	180	74248
20	49400	50	6659	47500	50	6403	157000	180	76189
21	110000	120	35587	44900	50	6053	151000	170	69206
22	121000	140	45670	42700	40	4605	150000	170	68748
23	127000	140	47935	33100	30	2677	149000	170	68290
24	116000	130	40656	20900	20	1127	162000	190	82983
25	116000	130	40656	21500	20	1159	220000	260	154210
26	124000	140	46803	33200	30	2685	222000	260	155610
27	124000	140	46803	26600	20	1434	197000	230	122160
28	130000	150	52572	27100	30	2192	173000	200	93282
29	126000	140	47557	--	--	--	159000	180	77160
30	129000	150	52168	--	--	--	154000	180	74733
31	124000	140	46803	--	--	--	169000	200	91125
TOTAL	2455100	--	702600	2178500	--	633403	4644900	--	2382037

Figure A8. Example of sediment data for Dardanelle, Arkansas (Source: Water Resources Data for Arkansas, 1974, USGS, Little Rock, Arkansas) (sheet 1 of 2)

ARKANSAS RIVER BASIN

07258000 Arkansas River at Dardanelle, Ark.--Continued

REMARKS.--Records furnished by Corps of Engineers, Little Rock, Ark.

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	169000	200	91125	180000	210	101910	72600	80	15658
2	163000	190	83495	190000	220	112690	90600	100	24426
3	163000	190	83495	176000	200	94899	109000	120	35264
4	164000	190	84007	170000	200	91664	142000	160	61253
5	162000	190	82983	164000	190	84007	179000	210	101340
6	165000	190	84520	160000	180	77645	186000	220	110320
7	167000	190	85544	190000	220	112690	158000	180	76674
8	161000	190	82471	202000	240	130700	145000	170	66456
9	168000	190	86056	187000	220	110910	133000	150	53785
10	160000	180	77645	169000	200	91125	124000	140	46803
11	157000	180	76189	156000	180	75704	121000	140	45670
12	157000	180	76189	160000	180	77645	123000	140	43425
13	153000	180	74248	159000	180	77160	112000	130	39254
14	153000	180	74248	158000	180	76674	85700	100	23105
15	152000	180	73763	157000	180	76189	66100	70	12474
16	176000	200	94899	157000	180	76189	54800	60	8864
17	184000	210	104170	157000	180	76189	67000	70	12644
18	196000	230	121540	153000	180	74248	74900	80	16154
19	190000	220	112690	154000	180	74733	82700	90	20066
20	182000	210	103040	155000	180	75218	74300	80	16025
21	180000	210	101910	153000	180	74248	84500	90	20503
22	201000	230	124640	152000	180	73763	77200	90	18732
23	300000	350	283080	147000	170	67373	64000	70	12078
24	264000	310	220640	140000	160	60390	74300	80	16025
25	233000	270	169610	137000	160	59096	60300	70	11380
26	218000	260	152810	124000	140	46803	56700	60	9172
27	213000	250	143560	120000	140	45293	48500	50	6538
28	206000	240	133290	113000	130	39604	46700	50	6295
29	199000	230	123400	102000	120	32999	46000	50	6201
30	186000	220	110320	85600	100	23078	46900	50	6322
31	--	--	--	74200	80	16003	--	--	--
TOTAL	5542000	--	3315577	4701800	--	2306839	2805800	--	945906

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	50600	50	6821	20100	20	1084	7320	0	0
2	45100	50	6079	19700	20	1062	1350	0	0
3	43400	40	4680	19800	20	1068	2250	0	0
4	31900	30	2580	18900	20	1019	7110	0	0
5	31000	30	2507	18000	10	485	8170	0	0
6	32200	30	2604	13200	10	356	20200	20	1089
7	24700	20	1332	8000	0	0	11900	10	321
8	641	0	0	9830	0	0	19800	20	1068
9	15200	10	410	11800	10	318	10400	10	280
10	24100	20	1299	8950	0	0	10800	10	291
11	28100	30	2273	10600	10	286	12400	10	334
12	24600	20	1326	14100	10	380	12900	10	348
13	19500	20	1051	17100	10	461	15600	10	421
14	21700	20	1170	18200	20	981	14700	10	396
15	15000	10	404	16500	10	445	2760	0	0
16	26800	20	1445	17500	10	472	8520	0	0
17	25600	20	1380	17800	10	480	11900	10	321
18	19300	20	1041	9780	0	0	6050	0	0
19	20600	20	1111	5730	0	0	12500	10	337
20	21000	20	1132	12800	10	345	10100	10	272
21	21000	20	1132	14800	10	399	14100	10	380
22	20500	20	1105	16300	10	439	9470	0	0
23	20900	20	1127	16500	10	445	565	0	0
24	22000	20	1186	19400	20	1046	11000	10	297
25	23000	20	1240	13500	10	364	15400	10	415
26	20700	20	1116	720	0	0	20600	20	1111
27	21300	20	1148	16000	10	431	31200	30	2523
28	22200	20	1197	15500	10	418	46700	50	6295
29	20800	20	1122	17600	10	474	47900	50	6457
30	19900	20	1073	15700	10	423	40100	40	4324
31	20200	20	1089	16700	10	450	--	--	--
TOTAL	753541	--	53180	451110	--	14131	443765	--	27280

Figure A8 (sheet 2 of 2)

Atchafalaya River at Simmesport, Louisiana

Station identification

OWDC No.: 54776

Agency station No.: 03045

Latitude/longitude: 305857/914754

Agency reporting to OWDC: CE

River mile: 8.2 (Mile 0 is at the confluence of the Lower Old River and the Red and Atchafalaya rivers; established by the CE in 1963.)

Site description

The sediment station is in a straight reach of the Atchafalaya River 3.3 miles south of Simmesport (Figure A9). There is no bank protection. Artificial levees have been constructed parallel to both banks. There is no cultural activity in the vicinity of the station that affects the sediment load. The stream-gaging station is located near the right bank of the downstream side of the Kansas City-Southern Railroad bridge at Simmesport (mile 4.9). The flow in the Atchafalaya consists of that from the Red River and controlled diversion from the Mississippi River by way of the Old River Control Structure. The gradient through the reach is 0.9 ft/mile, and the bed material is composed mainly of fine sands. The Atchafalaya River is navigable to commercial traffic. The discharges of record (1887-1892, and 1903 to the present) are: maximum - 781,000 cfs; mean - 211,000 cfs; and minimum - 10,500 cfs. The sediment loads of record (1952 to the present) are: maximum - 2,118,000 tons/day; mean - 260,000 tons/day; and minimum - 26,000 tons/day.

Station chronological record

The station was established at a discharge range in 1952 to monitor sediment flow into the Atchafalaya Basin through the Atchafalaya River. The CE New Orleans District (NOD) is responsible for collecting the samples and for reducing and publishing the data resulting from the laboratory analysis. Prior to 1973, the samples were analyzed by the NOD Laboratory but are not analyzed by the USGS Louisiana District Laboratory in Baton Rouge.

Sample and data collection procedures

Usually, samples are taken weekly from a boat with a US P-61 sampler, on three verticals with five samples on each vertical. The samples are taken at 10, 25, 50, 75, and 90 percent of the depth of the vertical, and the verticals are 1200, 1600, and 2000 ft from a reference marker on the right bank. Samples are taken every other day during high flows. Prior to 15 April 1974, a US P-46 sampler was used. Bed-material samples are taken with a drag bucket. Discharge and temperature observations are taken at the sediment station each day that the suspended-sediment samples are taken.

River stage was initially read at Simmesport with a staff gage, which was later replaced by a wire-weight gage. In 1963, a Stevens Model A-35B continuous recorder was added to the installation.

Laboratory sample analysis

From March 1958 to June 1973, sediment samples were analyzed by the Testing Section, Foundations and Materials Branch, NOD; since June 1973, the USGS Louisiana District has analyzed these samples at its Baton Rouge, Louisiana, Laboratory. In the following paragraphs are the procedures (adapted from Reference 4) used by both agencies.

Samples, when received in the laboratory, are checked against field notes, stored on a shelf in a dark room, and allowed to settle for approximately three weeks until clear. Fifty cubic centimetres of the clear water are drawn off each sample for a chloride determination, and the remaining clear water is drawn off each sample by means of a vacuum line with a waste bottle. About 30-40 ml of distilled water are added to each sample, and the sample is dispersed with a magnetic stirrer in the bottle. The solids and distilled water composing each sample are washed onto a U. S. No. 230 (0.0625-mm) sieve with more distilled water until the fines have passed through the sieve. As the fines pass through the U. S. No. 230 sieve, a sample splitter divides the fines into two portions with one half going into a 100-ml beaker (of known tare weight) and the other half going into a 2000-ml beaker (of known tare

weight). The sand retained on the U. S. No. 230 sieve is then washed into a 100-ml beaker (of known tare weight). Each 100-ml beaker (one containing the sands and the other one half of the fines) is placed in an oven for approximately 18 hr at 175°C. The 2000-ml beaker is set aside and allowed to settle until clear (analysis of the contents of this beaker continued in second paragraph on page A27).

After approximately 18 hr, or after all the moisture has been dried from the beakers, the 100-ml beakers are removed from the oven and placed in desiccators until they cool to 27°C. The sands and fines are weighed to 0.0001 g. The sands are then sieved on a nest of 3-in. tared sieves (U. S. No. 35 or 0.500-mm, U. S. No. 60 or 0.250-mm, U. S. No. 120 or 0.125-mm, and U. S. No. 230 or 0.0625-mm) and the accumulative gross weight on each sieve is recorded. The net sand weight is computed by subtracting the tare (sieve) weight from the gross weight. The net weight includes fines that were not passed through the U. S. No. 230 sieve and remained with the sands prior to oven-drying.

Three drops of hydrochloric acid are added to the 2000-ml beaker to accelerate the settling of the sample, and the beaker is covered and allowed to settle for approximately two weeks. After the fines have settled in the 2000-ml beaker, the clear water is drawn off, and the total volume of the beaker is measured. Fifty millilitres of the clear water are placed in a 100-ml beaker for a dissolved-solid correction. The remaining fines are washed into a mechanical disperser, agitated for approximately 2 min, and then washed into a bottom withdrawal (BW) tube. Distilled water is added until the fluid level reaches the 100-cm mark on the BW tube. The fines are mixed in the BW tube by continuously inverting the tube end-over-end. After mixing for 5 min, the tube is placed in a rack for drawdown. At time intervals of 4, 8, 13.5, 25, 50, 66, 88, 100, and 120 min, 10 cm is drawn down from the bottom of the tube into a beaker, and the last 10 cm is emptied into a beaker. Temperatures are measured at the beginning, middle, and end of the determination and are then averaged and recorded. After all the sample has been drawn down from the BW tube, the fines that adhere to the sides of the BW tube are washed into a 100-ml beaker for determination of a

wash correction. The BW samples, dissolves, and wash correction beakers are placed in an oven for approximately 18 hr and then weighed to 0.0001 g to determine the dry weight of the material in the beakers.

Data reduction procedures

The results of the laboratory analyses are entered on the LMN Form 766 (Figure A10) by the NOD personnel, and all nonshaded fields are punched on computer cards. The cards containing these data and the discharge data are entered through a remote terminal to the WES Honeywell G-635 computer. Data are compiled using the computer program, "SEDIMENT" (NOD No. 723-F3-A2-070), which uses an Oden Curve to analyze the bottom withdrawal data. Sediment retained on the U. S. No. 230 sieve is discharge weighted. Total sand and silt loads are included on the output. The information for the entire water year (including daily discharge values) is then input into the computer program "SSEDCF" (NOD No. 723-F3-A2-200), which calculates a total sediment for the water year.

Data reporting procedures

No sediment data were published prior to water year 1973. Beginning in water year 1973, these data were published in Reference 5. Figure A11 is an example of sediment data for this station (provided by the NOD).

General information

Additional information on this station can be obtain from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, Louisiana 70160.

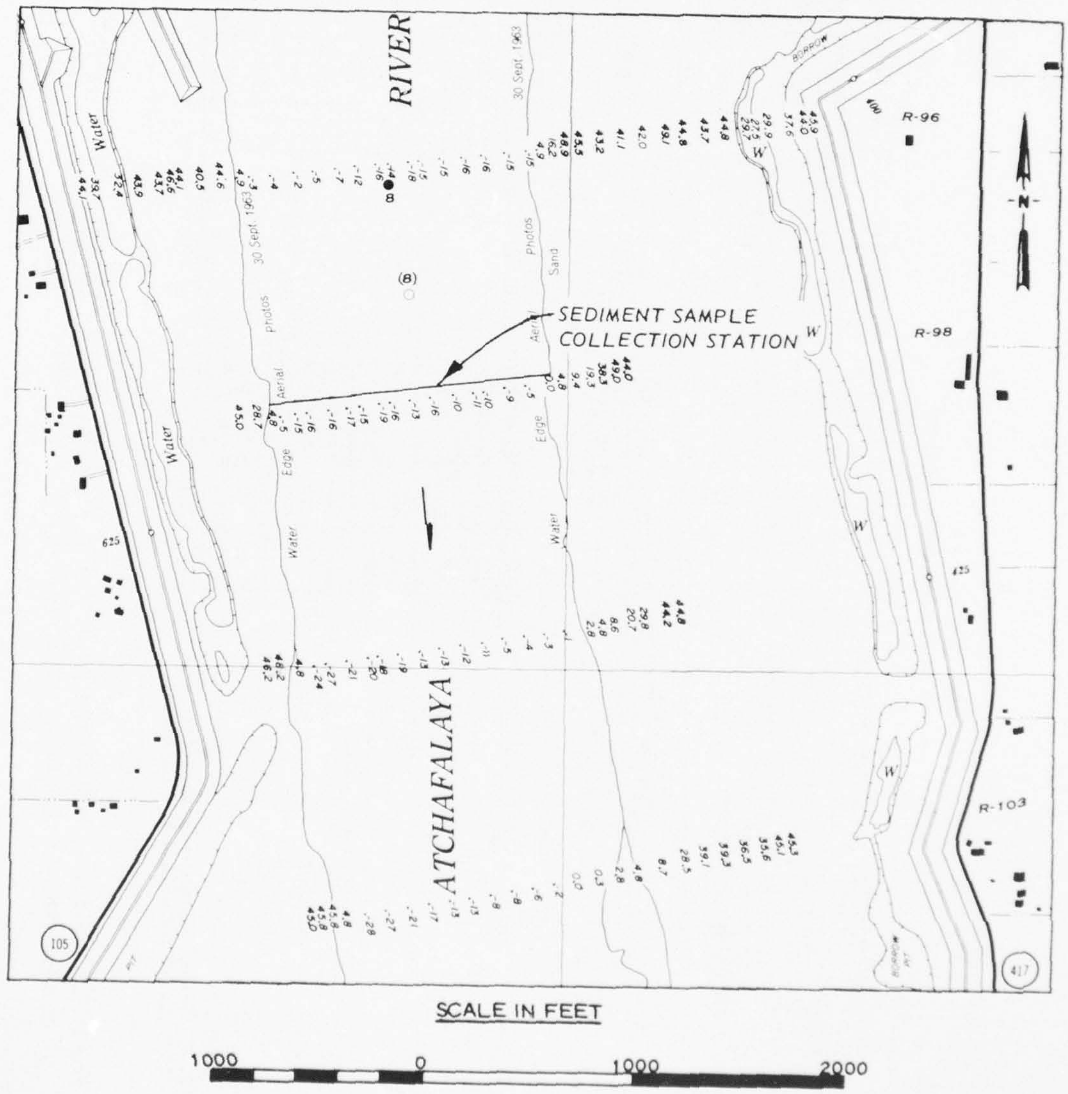
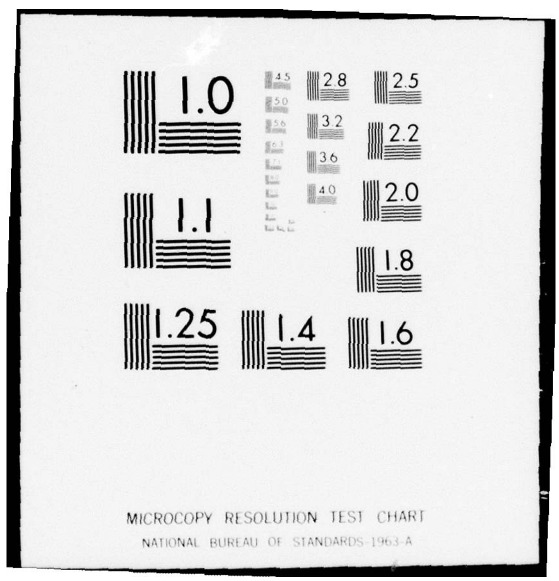


Figure A9. Site location for Simmesport, Louisiana, sediment sample collection station (Source: Map 7, Atchafalaya River Hydrographic survey, 1962-1964, U. S. Army Engineer District, New Orleans, Louisiana, 1967)

AD-A039 571 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 8/8
INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISS--ETC(U)
MAR 77 M P KEOWN, E A DARDEAU, J G KENNEDY
UNCLASSIFIED WES-TR-M-77-1 NL

2 OF 6
ADA039 571


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

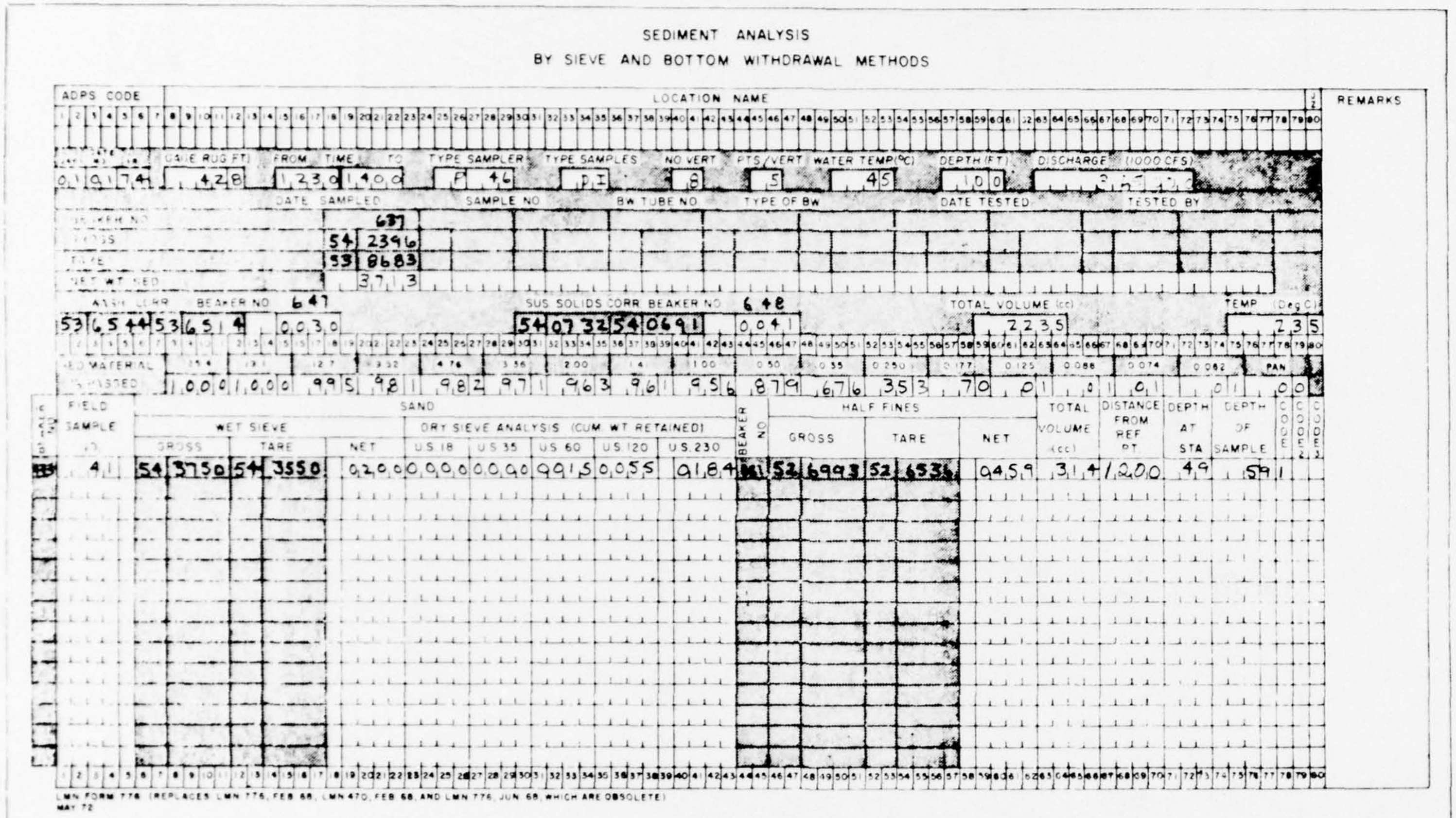


Figure A10. LMN Form 766 used for entering the results of laboratory analysis for keypunching on cards used as input to the NOD computer program "SEDIMENT"

ATCHAFALAYA RIVER AT SIMMESPORT, LA.
SUSPENDED SEDIMENT OBSERVATIONS

DATE	Q 1000	P.P.M.			1000 TONS/DAY		
MO DA YR	CFS	TOT	SAND	SILT	TOTAL	SAND	SILT
10/12/73	182,024	511.	32.	479.	251,066	15,859	235,206
11/ 9/73	223,400	985.	77.	908.	593,686	46,568	547,118
11/21/73	154,707	393.	43.	350.	164,042	17,860	146,183
12/ 7/73	347,776	1229.	144.	1085.	1152,763	135,403	1017,360
12/11/73	403,451	975.	187.	788.	1060,737	203,818	856,919
12/18/73	414,160	533.	128.	405.	594,905	142,732	452,174
12/28/73	361,001	723.	216.	507.	703,344	209,981	493,363
1/ 3/74	345,000	646.	206.	440.	600,635	191,491	409,144
1/10/74	390,000	526.	211.	315.	552,671	221,464	331,207
1/17/74	406,000	621.	244.	377.	680,077	267,654	412,423
1/25/74	448,000	459.	188.	271.	554,501	226,674	327,827
2/ 1/74	483,000	441.	152.	289.	574,091	197,338	376,753
2/ 5/74	507,000	288.	109.	179.	393,647	149,612	244,235
2/ 8/74	503,000	314.	149.	165.	426,440	202,484	223,956
2/14/74	538,000	203.	92.	112.	294,713	132,849	161,864
2/16/74	528,000	194.	98.	96.	275,879	139,648	136,231
2/18/74	520,000	157.	56.	100.	219,480	79,199	140,281
2/22/74	508,000	185.	67.	117.	252,799	92,098	160,702
2/24/74	479,000	260.	109.	152.	336,432	140,161	196,272
2/26/74	459,000	286.	117.	169.	354,542	145,275	209,267
3/ 1/74	439,000	301.	131.	170.	356,034	155,163	200,871
3/ 6/74	413,000	572.	263.	309.	637,052	292,660	344,392
3/ 8/74	405,000	315.	119.	196.	343,575	129,964	213,611
3/13/74	370,000	346.	129.	218.	345,472	128,391	217,081
3/15/74	358,000	339.	161.	178.	327,297	155,892	171,406
3/19/74	353,000	299.	107.	193.	284,926	101,493	183,433
3/22/74	356,000	356.	106.	250.	341,472	101,606	234,866
3/26/74	398,000	234.	62.	172.	251,228	66,778	184,450
3/29/74	392,000	255.	91.	164.	269,756	96,332	173,424
4/ 2/74	394,000	268.	104.	164.	285,008	110,965	174,044
4/ 5/74	381,000	261.	116.	145.	268,299	119,406	148,893
4/ 9/74	368,000	235.	82.	153.	232,818	81,443	151,375
4/12/74	376,000	278.	96.	182.	281,498	97,409	184,090
4/16/74	411,000	37.	12.	25.	41,451	13,333	28,118
4/19/74	423,000	30.	10.	19.	33,718	11,635	22,083
4/23/74	417,000	336.	122.	214.	377,302	136,817	240,484
4/26/74	444,000	262.	88.	173.	313,107	105,566	207,541
4/30/74	426,000	378.	98.	280.	434,394	112,797	321,597
5/ 3/74	414,000	347.	74.	273.	387,616	82,770	304,846
5/ 8/74	381,000	419.	84.	335.	430,035	85,789	344,246
5/10/74	363,000	817.	68.	748.	799,292	66,799	732,493
5/14/74	342,000	569.	81.	488.	524,833	74,545	450,287
5/17/74	328,000	440.	72.	367.	388,806	64,020	324,786
5/31/74	319,000	506.	68.	438.	435,584	58,685	376,899
6/ 7/74	345,000	485.	82.	403.	451,102	75,962	375,140
6/13/74	402,000	726.	116.	610.	787,429	125,706	661,723
6/18/74	467,000	611.	117.	494.	769,373	146,825	622,548
6/25/74	477,000	378.	83.	295.	486,051	106,415	379,636
7/ 9/74	381,000	345.	55.	291.	354,726	56,241	298,485
7/19/74	258,000	397.	48.	349.	275,899	33,339	242,559
7/31/74	168,000	323.	37.	285.	146,108	16,798	129,309
8/ 6/74	139,000	254.	15.	240.	95,297	5,446	89,851
8/13/74	982,000	217.	5.	212.	575,112	14,538	560,574
8/20/74	127,000	208.	16.	193.	71,385	5,370	66,015
8/27/74	134,000	175.	12.	163.	63,081	4,235	58,846
9/ 6/74	167,000	279.	19.	260.	125,486	8,516	116,971
9/10/74	212,000	420.	30.	390.	239,982	17,008	222,975
9/17/74	240,000	442.	79.	363.	285,981	51,122	234,859
9/24/74	243,000	584.	44.	540.	382,389	28,570	353,819

Figure A11. Example of sediment data for Simmesport, Louisiana (printout provided by the U. S. Army District, New Orleans)

Big Blue River Below Tuttle Creek Dam, Kansas

Station identification

OWDC No.: 54657

Agency station No.: 171-3

Latitude/longitude: 391458/963535

Agency reporting to OWDC: CE

River mile: 10.0 (Mile 0 is at the confluence of the Big Blue and Kansas rivers; mile 147.5 on the Kansas; established by the CE in 1957.)

Site description

The station is at the end of the outlet structure of Tuttle Creek Dam (Figure A12). The dam is a compacted earthfill structure, 7500 ft long and 157 ft above the streambed, with a controlled chute spillway; it is 5 miles north of Manhattan, Kansas. Storage in Tuttle Creek Reservoir began 15 March 1962. The streambed material at this station consists of sand, and the channel gradient is 1.6 ft/mile. Downstream from the station, riprap has been placed on the streambanks. The land in the vicinity of the station is used primarily for agriculture. Annual soil loss due to erosion in this region is 500-1000 tons/square mile.

From April 1918 to December 1959, a stream-gaging station was in operation at State Highway 16 Bridge, 0.75 mile east of Randolph, Kansas, at mile 32.3. The discharges of record from this station, which represent conditions prior to the closure of Tuttle Creek Dam (1962) are: maximum - 98,000 cfs; mean - 1,686 cfs; and minimum - 98 cfs. The sediment loads measured during the first part of the period of record (1960-1962) were: maximum - 1,359,000 tons/day; mean - 25,100 tons/day; and minimum - 8 tons/day. After construction of the dam, discharge records were obtained from the gaging station near Manhattan, Kansas, 2.5 miles downstream from the structure. The discharges of record at this station since the dam was closed (1960 to the present) are: maximum - 31,500 cfs; mean - 2,011 cfs; and minimum - 6 cfs. The suspended sediment loads of record at the outfall of the dam (1962-1972) are: maximum - 260,000

tons/day; mean - 2,345 tons/day; and minimum - 0 ton/day.

Station chronological record

The sediment sample collection station was established by the CE Kansas City District (KCD) in January 1960 and closed in September 1972. The sediment sample collection station was located downstream from the dam to monitor the sediment loads needed to determine the trap efficiency of the reservoir. During the period of record, the samples were collected by the KCD personnel at the reservoir. The KCD was responsible for analyzing the samples and reducing and reporting the results of the laboratory analyses.

Sample and data collection procedures

Surface grab samples were taken with milk bottles once weekly by the KCD personnel.

River stage was monitored by the USGS Kansas District at Randolph with a water-stage recorder during the latter part of the period of record and probably with a nonrecording gage during the earlier part of the period of record. At Manhattan (also a USGS station), the gaging record began in April 1895 and was discontinued October 1905 (the gaging data from this period were later found to be unreliable); a nonrecording gage was used from May to July 1951 and 1 October to 7 November 1954. On 18 November 1954, a Stevens graphical recorder was put into operation, and a Fisher-Porter automatic digital recorder (Model 1542) was added to the installation. Both recorders are driven by a manometer.

Laboratory sample analysis

Prior to May 1973, the samples were analyzed in the KCD Laboratory. No documentation is available on the procedures used in this laboratory. The resulting data included suspended-sediment concentration and particle-size distribution (on an irregular basis).

From May 1973 to September 1973, the samples were analyzed in the CE Missouri River Division Soils Laboratory in Omaha following the procedures discussed in References 6-8. Particle-size distributions were run on a regular basis.

Beginning in September 1973, the USGS Kansas District in Lawrence

analyzed the samples following the procedures discussed in Reference 1b.

Data reduction procedures

Prior to 1966, computations of daily suspended-sediment loads were performed manually. From 1966-1969, a computer program requiring a large number of input parameters, including seasonal and terrain conditions as well as concentrations and discharges, was used. Although this program worked satisfactorily when used with the correct input, it proved to be too cumbersome. (No documentation is available on this program.) In 1969, the "Suspended Sediment Load Computer Program" (also referred to as the "Kansas City Load Program") was written. This program, a simplified version of the one in use from 1966-1969, requires inputs of only concentrations and discharges. These data are entered on computer cards via a remote terminal in Kansas City to the CDC-7600 computer in Berkeley, California. The program is capable of interpolating up to 59 days of missing concentration record, provided a discharge value is available; accuracy, of course, decreases as the width of the data gap increases. Reference 9 discusses the "Kansas City Load Program" and its use.

The USGS uses Water Resources Division programs to reduce its data; Reference 10 describes the procedures used.

Data reporting procedures

Suspended-sediment load data are published in Reference 11. Discharge data for Randolph and Manhattan for years prior to 1961 were published in Reference 12; after 1961, these data were published in Reference 10. Figures A13 and A14 show samples of sediment and discharge data reported for this station.

General information

Sediment records are considered good. The discharge records are considered good except for those periods when ice was present.

Additional information on this station can be obtained from: U. S. Army Engineer District, Kansas City, Hydrologic Engineering Branch, Water Control Section, 700 Federal Building, 601 East 12th Street, Kansas City, Missouri 64106.

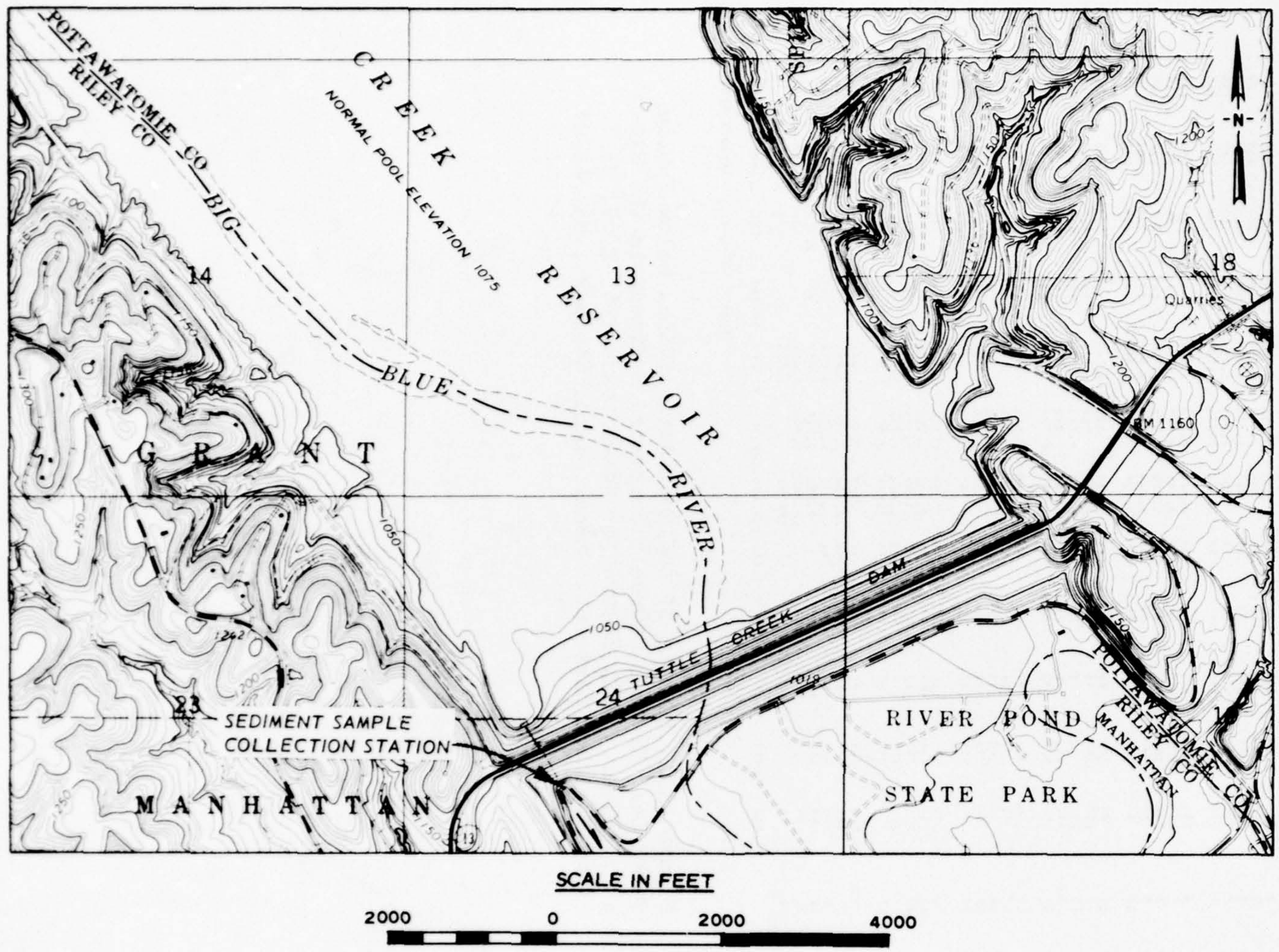


Figure A12. Site location for sediment sample collection station below Tuttle Creek Dam, Kansas (Source: USGS Quadrangle Map for Tuttle Creek Dam, Kansas, 1964)

BIG BLUE RIVER AT TUTTLE CREEK RESERVOIR, KANSAS

SUSPENDED SEDIMENT LOAD - TONS — WATER YEAR OCT 1968 - SEP 1969

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	270	54	405	81	108	363	6,885	6,480	1,701	162	162	27
2	216	54	162	162	162	405	2,447	5,184	891	203	216	27
3	216	54	651	70	108	405	1,723	2,244	851	203	203	54
4	270	54	675	61	54	635	1,604	1,350	151	162	162	135
5	216	108	540	41	54	2,592	3,191	1,134	97	122	203	135
6	270	162	270	41	54	8,424	2,970	1,501	672	81	122	135
7	216	108	77	26	122	7,655	4,707	1,377	810	81	203	135
8	162	162	103	22	270	4,720	5,670	1,539	2,160	383	122	135
9	108	243	77	22	135	3,024	6,750	6,518	221	324	203	135
10	63	162	77	22	135	3,024	2,381	6,480	162	324	122	99
11	81	162	64	22	118	2,228	182	2,747	135	324	162	81
12	115	243	49	22	54	2,025	510	1,436	135	415	162	81
13	122	81	61	22	54	1,890	4,611	1,323	135	648	122	81
14	243	162	73	22	54	1,620	7,290	1,229	162	379	79	41
15	162	405	85	22	54	898	7,290	839	162	270	47	41
16	176	324	97	22	54	405	7,560	540	135	170	47	41
17	81	162	61	22	54	405	6,338	540	81	122	65	41
18	54	162	37	11	108	757	6,804	540	157	81	65	41
19	54	379	24	11	243	539	3,159	675	122	81	86	28
20	54	405	93	11	127	41	1,944	675	122	122	86	22
21	81	540	162	26	46	14	1,620	608	122	301	54	22
22	234	405	162	27	92	1,081	1,350	473	122	324	41	22
23	270	392	162	27	46	1,890	1,975	789	81	486	41	16
24	270	405	162	99	46	1,890	9,734	2,471	81	648	41	14
25	270	243	122	108	46	1,620	10,870	2,592	122	648	27	14
26	518	324	81	378	75	3,969	4,921	2,160	446	324	27	14
27	389	486	122	54	89	8,424	3,726	3,456	162	648	49	14
28	181	162	162	54	244	9,072	1,071	6,629	81	810	27	14
29	108	567	243	108		9,720	3,617	3,882	446	2,916	27	14
30	108	324	203	108		15,660	6,480	2,025	162	631	27	14
31	54		162	54		14,260		1,863		224	27	
	5,632	7,494	5,424	1,778	2,806	109,655	129,380	71,299	10,887	12,617	3,027	1,673

YEARLY TOTAL = 361,672 TONS

Figure A13. Example of sediment data station below Tuttle Creek Dam, Kansas (Source: Suspended Sediment in the Missouri River, Daily Record for Water Years 1965-1969, U. S. Army Engineer District, Omaha, Omaha, Nebraska, May 1972)

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2,080	2,020	2,890	1,500	2,050	17,200	6,230	9,350	2,650	1,440	1,910	958
2	2,070	2,020	3,730	1,270	2,050	17,300	2,940	4,940	3,140	1,460	1,640	1,270
3	2,100	2,010	4,730	805	2,040	20,500	2,580	2,540	4,220	1,450	1,390	3,860
4	2,080	2,010	4,710	800	2,050	24,100	3,100	2,070	718	1,450	1,390	5,050
5	2,070	2,020	3,690	796	2,090	23,600	4,880	2,480	1,430	1,430	1,390	5,100
6	2,060	2,000	1,180	698	2,680	21,000	6,460	2,930	4,300	1,440	1,380	5,090
7	2,060	1,990	462	461	4,600	14,000	10,300	2,940	4,300	2,220	1,380	5,080
8	2,060	2,560	463	460	4,580	8,090	10,400	7,280	2,830	4,040	1,380	5,050
9	1,680	3,010	461	461	4,590	7,530	7,090	16,300	1,130	4,070	1,370	4,570
10	1,080	3,020	460	458	3,360	6,510	1,840	12,000	1,110	4,050	1,360	2,020
11	1,270	3,000	462	456	2,090	4,430	590	4,710	1,120	5,670	1,360	1,330
12	1,570	3,000	459	455	2,100	4,400	3,480	3,240	1,130	7,720	1,360	1,330
13	1,570	3,000	455	455	2,100	4,370	8,300	3,270	1,120	6,530	1,080	1,320
14	1,580	2,990	460	458	2,130	4,000	9,510	3,040	1,120	3,090	250	1,320
15	1,380	2,980	460	461	2,130	2,860	9,420	2,340	1,090	1,890	670	1,320
16	1,150	2,980	460	462	2,120	2,780	8,650	2,340	1,090	1,380	674	1,320
17	1,140	2,980	460	461	2,120	3,150	6,750	2,300	1,270	1,360	674	1,310
18	1,140	3,090	521	460	3,130	4,120	5,190	2,290	1,440	1,360	673	1,190
19	1,130	4,700	699	465	3,940	1,610	2,370	2,290	1,430	1,820	668	777
20	1,120	4,710	1,520	746	1,800	227	2,330	2,270	1,410	2,760	574	770
21	2,690	4,710	1,520	1,080	1,790	2,140	2,280	2,320	1,420	6,010	487	770
22	4,810	4,260	1,520	1,080	1,820	8,550	2,550	2,770	1,450	6,010	485	714
23	4,830	2,910	1,520	1,460	1,820	10,100	7,840	8,900	1,470	6,030	485	480
24	4,810	2,910	1,520	2,050	1,850	11,100	16,500	15,100	1,470	6,490	485	470
25	4,810	2,920	1,520	2,050	2,320	18,900	12,500	15,000	1,470	6,150	485	470
26	4,810	2,910	1,520	2,060	3,070	27,000	6,180	14,900	1,440	6,080	656	470
27	3,550	2,900	1,520	2,060	4,850	27,500	4,650	13,200	1,440	6,050	957	470
28	2,040	2,900	1,500	2,060	11,200	26,900	3,010	7,010	1,470	6,030	959	470
29	2,020	2,890	1,500	2,050	------	23,700	8,700	3,510	1,440	5,510	958	470
30	2,020	2,890	1,500	2,050	------	18,600	10,300	2,720	1,440	2,900	959	465
31	2,030	------	1,500	2,050	------	11,900	------	2,700	------	1,950	962	------
TOTAL	70,810	88,290	45,372	32,638	82,470	378,167	186,920	179,050	52,554	115,840	30,451	55,284
MEAN	2,284	2,943	1,464	1,053	2,945	12,200	6,231	5,776	1,752	3,737	982	1,843
MAX	4,830	4,710	4,730	2,060	11,200	27,500	16,500	16,300	4,300	7,720	1,910	5,100
MIN	1,080	1,990	455	455	1,790	227	590	2,070	718	1,360	250	465
AC-FT	140,400	175,100	89,990	64,740	163,600	750,100	370,800	355,100	104,200	229,800	60,400	109,700

CAL YR 1968 TOTAL 525,246 MEAN 1,435 MAX 12,900 MIN 42 AC-FT 1,042,000
WTR YR 1969 TOTAL 1,317,850 MEAN 3,611 MAX 27,500 MIN 227 AC-FT 2,614,000

Figure A14. Example of discharge data station near Manhattan, Kansas (Source: Water Resources Data for Kansas, 1969, USGS, Lawrence, Kansas)

Big Nemaha River at Falls City, Nebraska

Station identification

OWDC No.: 54674

Agency station No.: 309

Latitude/longitude: 400200/953530

Agency reporting to OWDC: CE

River mile: 13.0 (Mile 0 is at the confluence of the Big Nemaha and the Missouri rivers at mile 494.9 on the Missouri River; established by the CE in 1969.)

Site description

The station was located from April 1949 to September 1967 on the U. S. Highway 73 Bridge, which crosses the Big Nemaha River 1 mile south of Falls City, Nebraska (Figure A15). There are no bank protection works and no artificial levees in the vicinity of the station. The channel was straightened prior to the establishment of the sediment station (early 1940's). The stream is not navigable for commercial traffic in this reach. The bed material is composed of sand, and the gradient through this reach is 1.3 ft/mile. There are floodplains on both sides of the station. The land upstream is used almost exclusively for agriculture (mainly growing corn). The annual soil loss due to erosion upstream from the station is 3000-6000 tons/square mile. The discharges of record (1944-1974) are: maximum - 71,600 cfs; mean - 590 cfs; and minimum - 4.3 cfs. The sediment loads of record (1949-1967) are: maximum - 3,360,000 tons/day; mean - 15,509 tons/day; and minimum - 0.4 ton/day.

Station chronological record

The sediment sample collection station was established by the CE Kansas City District (KCD) in April 1949 to monitor sediment flows in this area as part of a program to establish yield rates for different types of soils, and was closed in September 1967. During the period of operation, the KCD was responsible for collecting and analyzing the samples as well as reducing and reporting the resulting data.

Sample and data collection procedures

Depth-integrated samples were collected using a US D-43 sampler from April 1949 to May 1950 and a US D-49 sampler from June 1950 until the station was closed. Sampling consisted of obtaining one vertical two times a week; however, during periods of high flow, as many as three verticals were taken daily. Periodic bed-material samples were also obtained. Stage was measured using a wire-weight gage read twice daily.

Laboratory sample analysis

For the period of record of this station, the information is identical to that presented for the Big Blue River sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

For the period of record of this station, the information is identical to that presented for the Big Blue River sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Prior to October 1965, the data for this station were published as Nemaha River at Falls City, Nebraska. Discharge data were published prior to 1961 in Reference 12 and since that date in Reference 13. Sediment data are published in Reference 11. Figures A16 and A17 show examples of sediment and discharge data reported for this station.

General information

Sediment records for this station are considered good; however, discharge records are fair except those for the winter period, which are poor.

Additional information on this station can be obtained from: U. S. Army Engineer District, Kansas City, Hydrologic Engineering Branch, Water Control Section, 700 Federal Building, 601 East 12th Street, Kansas City, Missouri 64106.

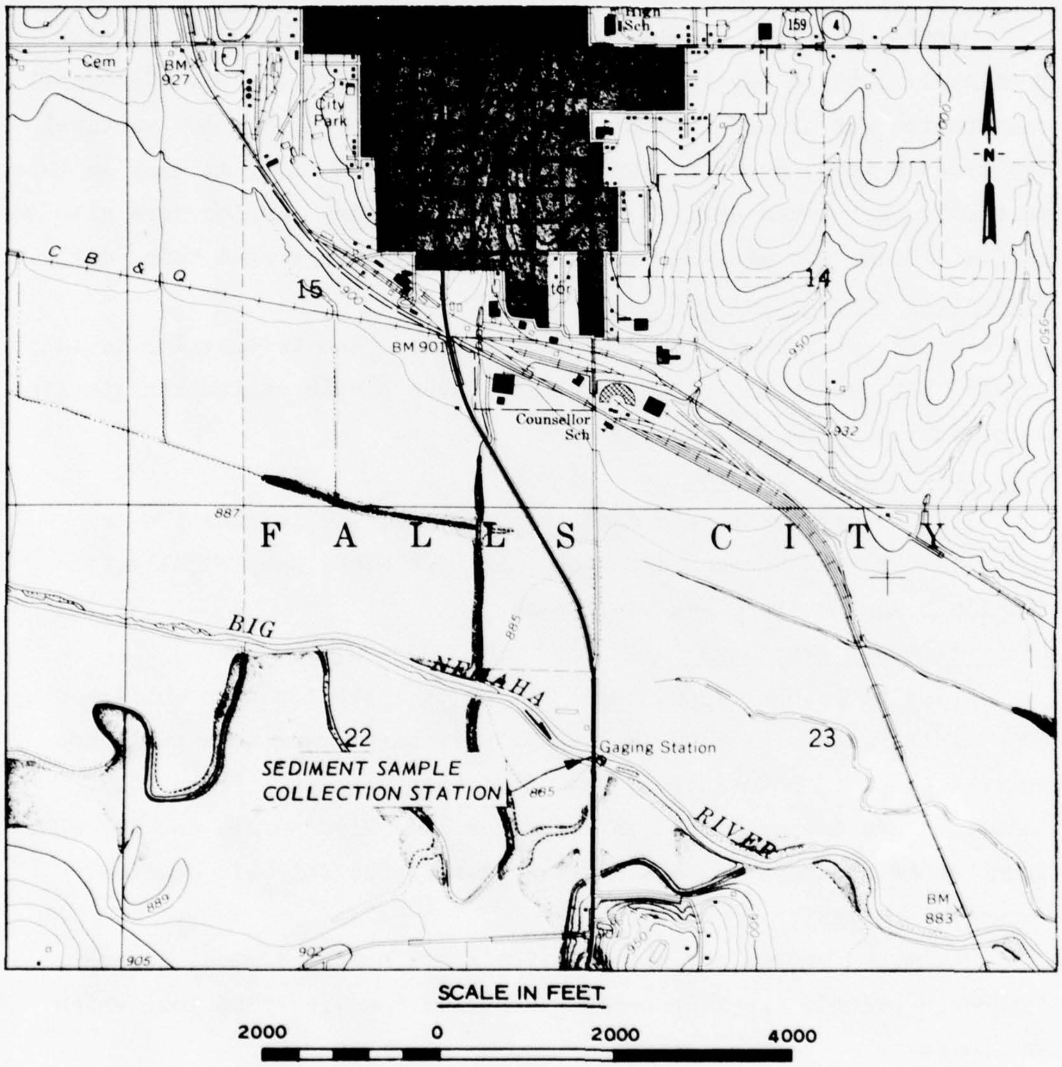


Figure A15. Site location for Falls City, Nebraska, sediment sample collection station (Source: USGS Quadrangle Map for Falls City, Nebraska-Kansas, 1965)

BIG NEMAHA RIVER AT FALLS CITY, NEBRASKA

SUSPENDED-SEDIMENT LOAD - TONS | WATER YEAR OCT 1966 - SEP 1967

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1	8	7	10	11	4	26	5	9,459	330	188	11
2	1	6	6	10	7	4	21	4	8,156	3,548	119	7
3	2	9	14	7	11	1	20	4	2,039	669	73	9
4	2	5	14	1	15	6	16	6	493	212	43	11
5	3	4	10	1	21	14	11	12	12,620	112	26	26
6	4	8	11	4	18	13	11	19	57,830	99	27	54
7	2	3	13	8	7	8	24	18	10,840	81	29	48
8	1	3	9	13	2	6	45	13	1,954	65	78	21
9	1	7	5	14	5	7	55	6	45,500	94	106	6
10	2	10	7	10	6	10	40	5	389,900	1,360	46	7
11	4	1	7	12	10	7	24	8	148,200	2,118	19	6
12	5	2	10	15	10	4	18	16	706,800	1,536	10	7
13	4	7	14	7	14	3	429	17	111,200	607	8	11
14	2	4	12	6	9	1	5,601	15	14,310	186	10	9
15	2	5	5	7	11	4	1,802	13	3,649	87	24	26
16	4	6	5	4	11	6	743	11	12,350	62	12	72
17	4	6	5	7	11	7	175	9	38,940	49	7	32
18	11	3	8	11	14	5	54	7	9,520	43	19	17
19	6	1	7	25	15	4	21	6	149,100	41	90	52
20	1	3	5	21	13	4	16	5	56,640	36	83	197
21	5	5	4	22	12	4	128	5	21,070	35	30	290
22	3	2	3	20	11	4	165	5	30,730	32	12	72
23	1	3	4	23	9	5	106	5	2,689	34	6	46
24	2	2	16	15	6	5	46	5	3,120	79	5	19
25	6	4	14	4	4	5	26	5	4,234	63	3	10
26	3	5	10	14	4	1,112	32	4	3,251	49	10	9
27	2	4	8	47	4	2,077	18	6	941	11,490	25	11
28	6	5	8	26	4	111	11	8	478	22,940	55	9
29	6	9	4	21		46	7	12	389	4,043	52	10
30	2	4	11	15		32	7	29	380	1,094	36	8
31	5		12	4		25		58		415	19	
	103	144	268	404	275	3,544	9,698	341	1,856,782	52,409	1,270	1,113

YEARLY TOTAL = 1,926,351 TONS

Figure A16. Example of sediment data for Falls City, Nebraska (Source: Suspended Sediment in the Missouri River, Daily Record for Water Years 1965-1969, U. S. Army Engineer District, Omaha, Omaha, Nebraska, May 1972)

NEMAHA RIVER BASIN

6-8150. Big Nemaha River at Falls City, Nebr.

Discharge, in cubic feet per second, water year October 1966 to September 1967

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	37	33	32	38	138	54	87	56	1,160	531	142	42
2	37	33	29	40	128	50	87	52	1,280	900	152	42
3	35	35	30	39	130	50	92	52	500	349	142	55
4	30	37	32	40	135	51	82	55	285	280	105	57
5	30	38	39	41	130	50	70	62	829	260	88	75
6	31	38	49	40	84	40	69	79	2,550	245	98	62
7	31	39	49	38	85	38	74	84	965	230	98	57
8	31	39	45	37	88	36	98	78	444	220	145	55
9	32	39	45	44	100	45	114	69	2,500	232	140	34
10	29	39	42	48	104	55	98	61	9,100	325	122	49
11	28	47	40	50	90	53	87	62	5,920	379	98	42
12	32	45	41	56	74	51	82	74	20,200	632	75	45
13	35	40	43	61	85	49	142	61	5,950	292	62	60
14	35	40	45	58	84	49	506	57	1,880	230	64	64
15	31	39	47	64	69	45	344	53	1,240	202	88	88
16	31	43	48	66	65	42	198	51	1,780	190	62	92
17	32	43	50	64	70	41	106	47	2,420	180	55	62
18	44	40	50	58	74	43	87	45	1,220	175	53	57
19	53	40	51	58	68	45	77	42	4,170	170	90	62
20	49	42	50	72	68	51	72	40	2,300	165	88	130
21	49	42	46	89	64	49	97	39	1,750	160	62	275
22	41	40	42	145	68	45	109	38	1,770	148	49	331
23	38	39	40	140	66	45	106	36	830	138	44	340
24	36	38	37	135	54	47	89	33	1,070	162	44	142
25	35	40	36	132	50	46	80	31	1,400	130	38	90
26	36	38	37	130	52	198	78	27	700	120	60	85
27	33	38	37	115	53	249	72	31	484	661	57	105
28	37	38	36	120	52	133	65	31	432	1,040	62	85
29	32	38	34	130	- - - - -	94	63	33	389	564	53	90
30	32	38	35	140	- - - - -	78	61	56	361	298	51	71
31	33	- - - - -	37	142	- - - - -	70	- - - - -	80	- - - - -	192	42	- - - - -
Total	1,095	1,178	1,274	2,430	2,328	1,992	3,392	1,615	75,879	9,800	2,529	2,844
Mean	35.3	39.3	41.1	78.4	83.1	64.3	113	52.1	2,529	316	81.6	94.8
Max	53	47	51	145	138	249	506	84	20,200	1,040	152	340
Min	28	33	29	37	50	36	61	27	285	120	38	34
Ac-ft	2,170	2,340	2,530	4,820	4,620	3,950	6,730	3,200	150,500	19,440	5,020	5,640

Cal yr 1966: Total 35,564 Mean 97.4 Max 1,370 Min 25 Ac-ft 70,530
Wtr yr 1967: Total 106,356 Mean 292 Max 20,200 Min 27 Ac-ft 211,000

Peak discharge (base, 15,000 cfs).--June 12 (0230) 32,700 cfs (25.90 ft).

Figure A17. Example of discharge data for Falls City, Nebraska (Source: Water Resources Data for Nebraska, 1967, USGS, Omaha, Nebraska)

Boyer River at Logan, Iowa

Station identification

OWDC No.: 52035

Agency station No.: 06609500

Latitude/longitude: 413833/954657

Agency reporting to OWDC: USGS

River mile: 15.8 (Mile 0 is 15.8 miles upstream from the confluence of the Boyer and Missouri rivers; established by the USGS in 1964.)

Site description

From 1964 to 1973, the station was on the Boyer River 300 yd downstream from the Illinois Central Railroad bridge at Logan and 0.4 mile downstream from Elk Grove Creek in an S-curve of the river (Figure A18). The right bank is protected by riprap at the railroad bridge. Logs and debris, which accumulate on this bank, cause considerable scour below the bridge. There is no bank protection on the left bank, and it is subject to flooding. The stream is not navigable for commercial traffic in this reach, and the streambed material consists of fine silts and sand. Channel gradient is 3.5 ft/mile. Agriculture is practiced along both banks. Annual soil loss due to erosion upstream from the station is 6,000-10,000 tons/square mile. The discharges of record (1918 to the present) are: maximum - 25,000 cfs; mean - 313 cfs; and minimum - 1.5 cfs. The sediment loads of record (1964-1973) are: maximum - 48,400 tons/day; mean - 1,876 tons/day; and minimum - 0.8 ton/day.

Station chronological record

In 1964, the sediment sample collection station was established by the USGS Iowa District because additional data were needed for this reach of the river. Sediment samples were collected by personnel of the USGS during the period of record. The USGS was also responsible for the laboratory analysis of the samples and for reducing and publishing the data. This station was closed in 1973.

Sample and data
collection procedures

Samples were collected at irregular intervals from a cable suspended on an A-frame 300 yd downstream from the railroad bridge. During high flows, a single depth-integrated sample was taken with a US D-49 sampler; during low flows, a grab sample was taken with a US DH-49 sampler. These samplers are discussed in Reference 1a.

Gaging in the vicinity of Logan began on 24 May 1918. It was discontinued from 2 July 1925 through 3 November 1937. On 4 November 1937, it was resumed. The gage is presently on the left bank of the Boyer River 9 ft downstream from the left pier of the Illinois Central Railroad bridge (mile 15.8). The tabulation below lists the gaging and recording devices used at this station during the period of record:

Period	Locality	Device Used
24 May 1918 - 16 April 1925	Old county bridge (300 ft downstream from present position) (mile 15.8)	Chain gage
17 April 1925 - 1 July 1925	Left bank (600 ft downstream from present position) (mile 15.7)	Cantilever gage
4 November 1937 - 16 March 1952	Old county bridge (300 ft downstream from present position) (mile 15.8)	Canfield wire-weight gage
22 October 1946 - 7 October 1954	U. S. Highway 30 Bridge (100 ft upstream from present position) (mile 15.8)	Stevens A-35 recorder (driven by float)
17 March 1952 - 30 September 1957	U. S. Highway 30 Bridge (100 ft upstream from present position) (mile 15.8)	Type A wire-weight gage
1 October 1957 - present	300 ft downstream from present position (mile 15.8)	Canfield wire-weight gage*
19 October 1960 - present	Present position (mile 15.8)	Stevens A-35 recorder (driven by manometer)

(Continued)

* Used as a backup gage since 19 October 1960, but read daily by a paid observer.

Period	Locality	Device Used
? - present	Present position (mile 15.8)	Digital punch-type recorder (driven by manometer)*

Laboratory sample analysis

The USGS Laboratory in Iowa City, Iowa, analyzed the samples for concentration and particle-size distribution following the methods described in Reference 1b.

Data reduction procedures

Sediment concentrations are plotted on a Stevens gage-height chart. A smooth curve is drawn through the points, and the mean daily concentration is computed from this curve. Daily sediment loads are computed by multiplying the mean daily discharge and mean concentration by 0.0027 to convert to tons per day. After four days of rapidly changing stage, water discharge and concentration data are subdivided, and total load is computed from the discharge for appropriate intervals of the day. Sediment loads during the periods of no samples are estimated on the basis of weather records, discharge and sediment records for nearby stations, and knowledge of the stream. Sediment computations for each water year are made with the USGS Water Resources Division sediment computer program W-4252. Reference 1c provides a detailed account of the data reduction procedure.

Data reporting procedures

The USGS published the sediment data annually in Reference 14. Figure A19 is an example of these data. Discharge data prior to 1961 were published in Reference 12, and since that date, in Reference 15.

General information

Discharge records are good except for the winter periods, which are poor.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

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* With attachment which enables query by National Weather Services.

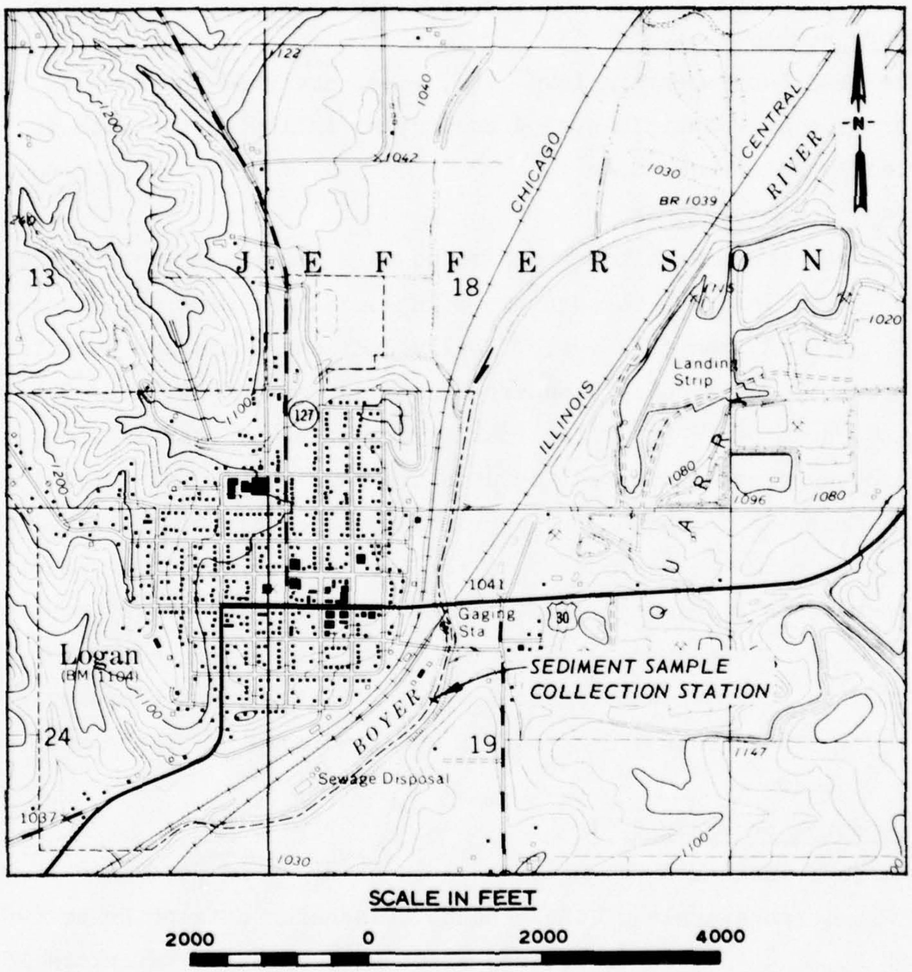

Figure A18. Site location for Logan, Iowa, sediment sample collection station (Source: USGS Quadrangle Map for Logan, Iowa, 1970)

Boyer River Basin
06-6095.00 Boyer River at Logan, Iowa

Date	Time (24 hr)	Water Temperature (°C)	Discharge (cfs)	Sediment Concen-tration (mg/ℓ)	Sediment Discharge (tons/day)
3 Nov 1967	0915	3	63	160	27.0
4 Dec	0935	1	43	29	3.4
5 Jan 1968	1035	0	13	22	0.8
2 Feb	1115	0	60	24	3.9
1 Mar	0930	1	41	10	1.1
1 May	1130	21	49	180	24.0
5 June	0930	23	25	130	8.8
24 June	1525	23	666	11,500	20,700.0
1 July	1440	24	229	1,850	1,140.0
5 Aug	1055	27	34	90	8.3
3 Sep	1020	22	43	250	29.0

Figure A19. Example of sediment data for Logan, Iowa (Source: Water Resources Data for Iowa, 1968, USGS, Iowa City, Iowa)

Boyer River (East Fork) at Denison, Iowa

Station identification

OWDC No.: 86832

Agency station No.: 772

Latitude/longitude: 420033/952003

Agency reporting to OWDC: CE

River mile: 2.0 (Mile 0 is at the confluence of the East Fork of the Boyer River and the Boyer River, which is 51.6 miles upstream from the confluence of the Boyer River with the Missouri River; the date river mileage was established is not known.)

Site description

From October 1968 to September 1974, the station was in the center of County Road "W" Bridge, which crosses a relatively straight reach of the East Fork of the Boyer River (Figure A20). The river banks in the vicinity of the station are natural and very steep (nearly vertical). The bed material is composed of sand and is very unstable. The stream is not navigable for commercial traffic in this reach. The gradient through the reach is approximately 2.5 ft/mile. Sand dredging operations were conducted 2 miles upstream from the station causing high sediment concentrations. The annual soil loss due to erosion upstream from the station is 3,000-6,000 tons/square mile. The discharges of record (1950-1974) are: maximum - 4,900 cfs; mean - 80 cfs; and minimum - 0.5 cfs. The sediment loads of record (1968-1974) are: maximum - 59,900 tons/day; mean - 924 tons/day; and minimum - 0 tons/day.

Station chronological record

The sediment station was operated by the CE Omaha District (OD) from October 1968 to September 1974. The station was established to monitor the contribution of sediment of the East Fork of the Boyer River to the Boyer River. Water stage was monitored at the station from July 1950 through September 1974. During the period of record, the OD was responsible for collecting the sediment samples and reporting the

resulting reduced data. The OD was also responsible for reducing the data prior to 1 July 1972. After this date, the USGS Iowa District reduced the data. Also, prior to 1 July 1972, the samples were analyzed in the CE Missouri River Division (MRD) Laboratory at Omaha. After this date, the samples were analyzed at the USGS Laboratory, Iowa City, Iowa.

Sample and data collection procedures

Samples were collected by paid observers approximately 95 percent of the time and by OD hydrographers during the remainder of the period of record. Depth-integrated samples were taken once every four days on one vertical during low flows, with additional samples taken during high flows. Surface grab samples were also obtained by using a milk bottle during periods of high flow. The sampling apparatus was in a fixed position in the center of the bridge. A US D-43 sampler was used to obtain the depth-integrated samples. The use of this sampler is described in Reference 1a.

River stage was measured prior to 1968 with a wire-weight gage. This gage was replaced by a Fisher-Porter automatic digital recorder in 1968.

Laboratory sample analysis

Prior to 1 July 1972, the MRD Soils Laboratory analyzed the samples for suspended-sediment concentration and bed material particle-size distribution, using the methods outlined in References 6-8. After the USGS Iowa District took over the stations, the USGS Soils Laboratory in Iowa City, Iowa, analyzed the samples for concentration and particle-size distribution following the methods described in Reference 1b.

Data reduction procedures

Prior to 1 July 1972, the OD computed sediment load (tons/day) from the suspended-sediment concentration reported from the laboratory analyses and the discharge. The data reduction procedure was automated in 1965 with the KCD load program (Reference 9). After 1 July 1972, the USGS Iowa District was responsible for data reduction. The data on concentrations obtained at the station were plotted on a gage-height chart, and a smooth concentration curve was drawn through points of sediment concentration. Daily sediment loads were computed by multiplying the

product of the mean daily discharge (cfs) and the mean concentration (mg/ℓ) by 0.0027 to convert to tons per day. These sediment computations were made with the Water Resources Division sediment computer program W-4252.

Data reporting procedures

Water discharge records are maintained by the CE; however, tabulated and published discharge records are not available. Figure A21 is a sample of sediment data reported for this station. The suspended-sediment load is reported by the CE in Reference 11.

General information

Additional information on this station can be obtained from: U. S. Army Engineer District, Omaha, Hydrologic Engineering Branch, Water Quality and Sediment Section, Federal Building, Omaha, Nebraska 68102.

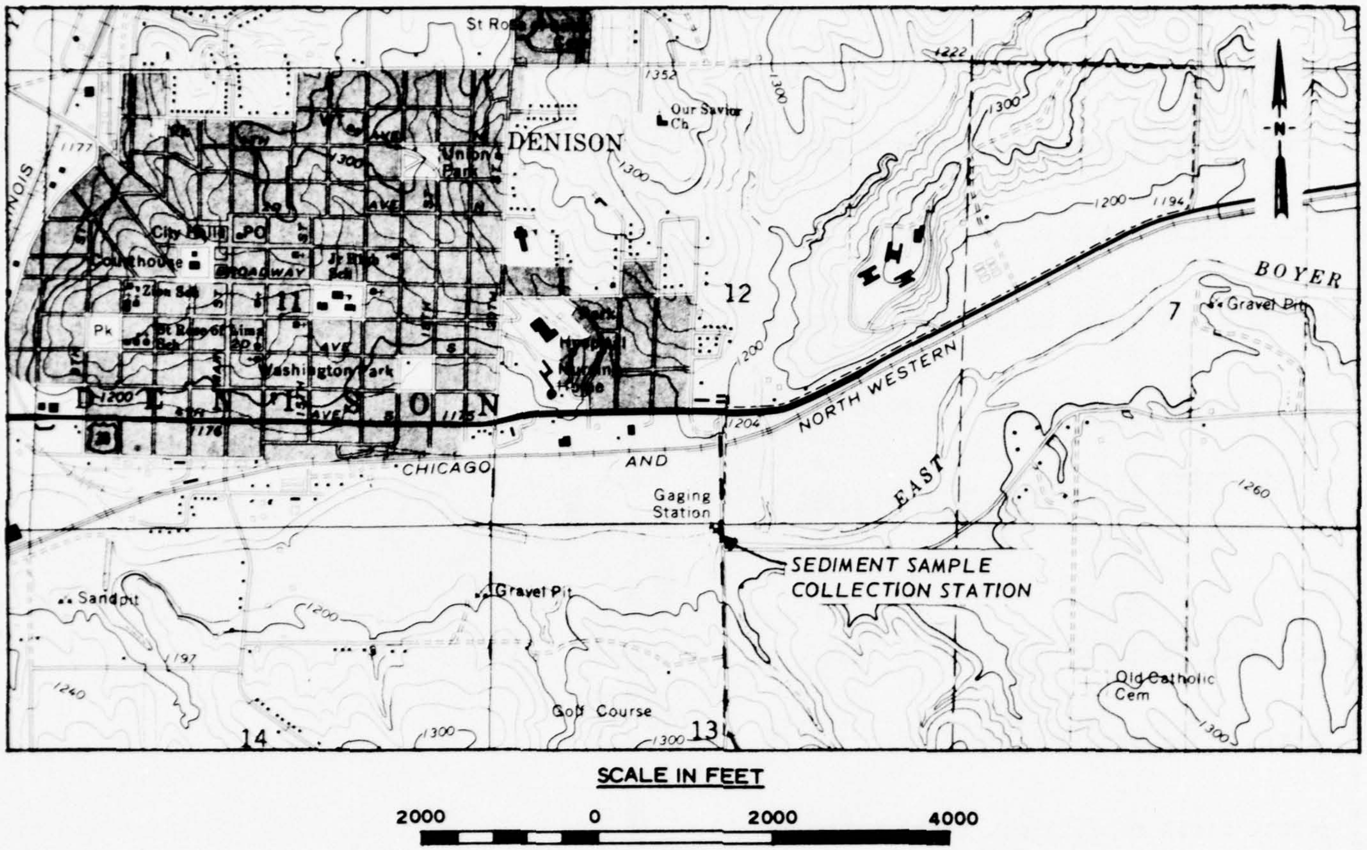

Figure A20. Site location for Denison, Iowa, sediment sample collection station (Source: USGS Quadrangle Map for Denison, Iowa, 1971)

EAST FORK BOYER RIVER AT DENISON, IOWA 6-02121.1

MEASURED SUSPENDED SEDIMENT LOAD IN TONS 1969 WATER YEAR

	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1	4.3	35	35	2.1		1.7	27700	46	21	8.2	45	34
2	2.6	53	27	2.3		1.2	2600	48	19	16	557	14
3	3.3	53	28	2.5		1.0	7520	52	17	496	59	10
4	2.6	22	29	2.7		0.6	15600	41	13	324	39	8.8
5	2.4	23	17	2.5		0.3	1220	30	14	31	32	23
6	4.7	31	22	2.6		0.2	698	65	13	49	38	14
7	3.4	34	14	2.8		0.2	613	34	14	3560	7610	15
8	16	40	9.6	2.9		0.1	579	40	14	288	34	8.3
9	787	44	11	3.0		0.1	460	34	10	9680	9500	7.5
10	56	53	11	2.8		0.1	272	32	7.2	185	48	6.6
11	34	64	11	2.9		0.1	250	27	19	108	38	20
12	29	65	11	2.6		0.1	261	27	657	98	32	7.4
13	32	72	10	2.7		0.1	228	27	140	96	36	6.4
14	31	100	9.0	1.9		0.1	255	24	92	72	27	18
15	30	316	8.6	9.7		4.9	261	30	62	81	22	6.7
16	62	187	8.2	30		41	425	29	40	314	23	5.6
17	1460	166	7.8	19		13200	953	55	32	574	22	4.8
18	360	95	4.8	13		59900	791	63	19	135	15	4.0
19	162	54	2.7	7.5		18800	286	69	11	96	14	4.1
20	96	37	1.4	3.4		30900	206	65	7.5	76	16	4.6
21	70	26	1.5	0.8		5380	133	84	5.7	49	16	4.2
22	46	39	1.5	0.1		6220	114	92	24	36	10	4.6
23	34	38	1.2	0.1		16400	96	78	29	19	8.7	4.8
24	28	29	1.3	0.1		29600	85	49	17	17	6.8	4.3
25	28	26	1.3	0.1		3270	79	41	16	26	5.4	4.2
26	27	34	1.3	0.1		3650	70	71	20	3730	4.5	4.4
27	26	23	1.5	0.1		3360	92	39	31	2950	4.2	4.5
28	31	25	1.5	0.1		2440	53	37	2740	102	5.2	5.5
29	38	26	1.6	0.0		567	41	26	494	80	4.3	6.1
30	35	40	2.0			543	46	29	20	58	4.3	5.5
31	36		2.0	0.0		619		20		61	436	
	3577	1850	295	120	50	194901	62067	1404	4632	23415	18712	271

YEARLY TOTAL 311,300

Figure A21. Example of sediment data for Denison, Iowa (Source: Suspended Sediment in the Missouri River, Daily Record for Water Years 1965-1969, U. S. Army Engineer District, Omaha, Omaha Nebraska, May 1972)

Boyer River at Deloit, Iowa

Station identification

OWDC No.: 86831

Agency station No.: 771

Latitude/longitude: 420540/951842

Agency reporting to OWDC: CE

River mile: 58.1 (Mile 0 is at the confluence of the Boyer and Missouri rivers; the date river mileage was established is not known.)

Site description

From 1969 to 1974, the station was in the center of a county road bridge over a straight reach of the Boyer River 0.5 mile south of Deloit and 0.5 mile upstream from the confluence of Otter Creek and the Boyer River (Figure A22). The river banks in the vicinity of the station are natural and very steep (almost vertical). The stream is not navigable for commercial traffic in this reach. The bed material is composed of clay, and the gradient through the reach is approximately 2.0 ft/mile. The annual soil loss due to erosion upstream from the station is 3,000-6,000 tons/square mile. There is no important diversion or storage of water above this station. The discharges of record (1968-1973) are: maximum - 5,590 cfs; mean - 154 cfs; and minimum - 0.5 cfs. The sediment loads of record (March 1969 to September 1974) are: maximum - 129,000 tons/day; mean - 3860 tons/day; and minimum - 4.7 tons/day.

Station chronological record

The sediment station was established by the CE Omaha District (OD) in 1969 and closed in 1974. During the period of record, the OD was responsible for collecting the sediment samples and reducing and reporting the resulting data. Prior to 1 July 1972, the samples were analyzed in the CE Missouri River Division Laboratory at Omaha. After this date, the samples were analyzed at the USGS Laboratory, Iowa City, Iowa.

Sample and data
collection procedures

Samples were collected by the contract observers approximately 95 percent of the time and by the CE hydrographers the remainder of the period of record. Depth-integrated samples were taken with a US D-43 sampler once every four days on one vertical during low flows, with additional samples taken hourly during high flows. The use of this sampler is described in Reference 1a. The sampling apparatus was in a fixed position in the center of the bridge. Surface grab samples were also obtained with a milk bottle during periods of high flows. Additional data collected consisted of water temperature, air temperature, and stage.

River stage was measured during the period of record with a Fisher-Porter automatic digital recorder.

Laboratory sample analysis

Information is identical to that presented for the Boyer River (East Fork) sediment sample collection station at Denison, Iowa.

Data reduction procedures

Information is identical to that presented for the Boyer River (East Fork) sediment sample collection station at Denison, Iowa.

Data reporting procedures

Water discharge records are maintained by the CE; however, tabulated and published discharge records are not available. Figure A23 is a sample of sediment data reported for this station. The suspended-sediment load is reported by the CE in Reference 11.

General information

Additional information on this station can be obtained from: U. S. Army Engineer District, Omaha, Hydrologic Engineering Branch, Water Quality and Sediment Section, Federal Building, Omaha, Nebraska 68102.

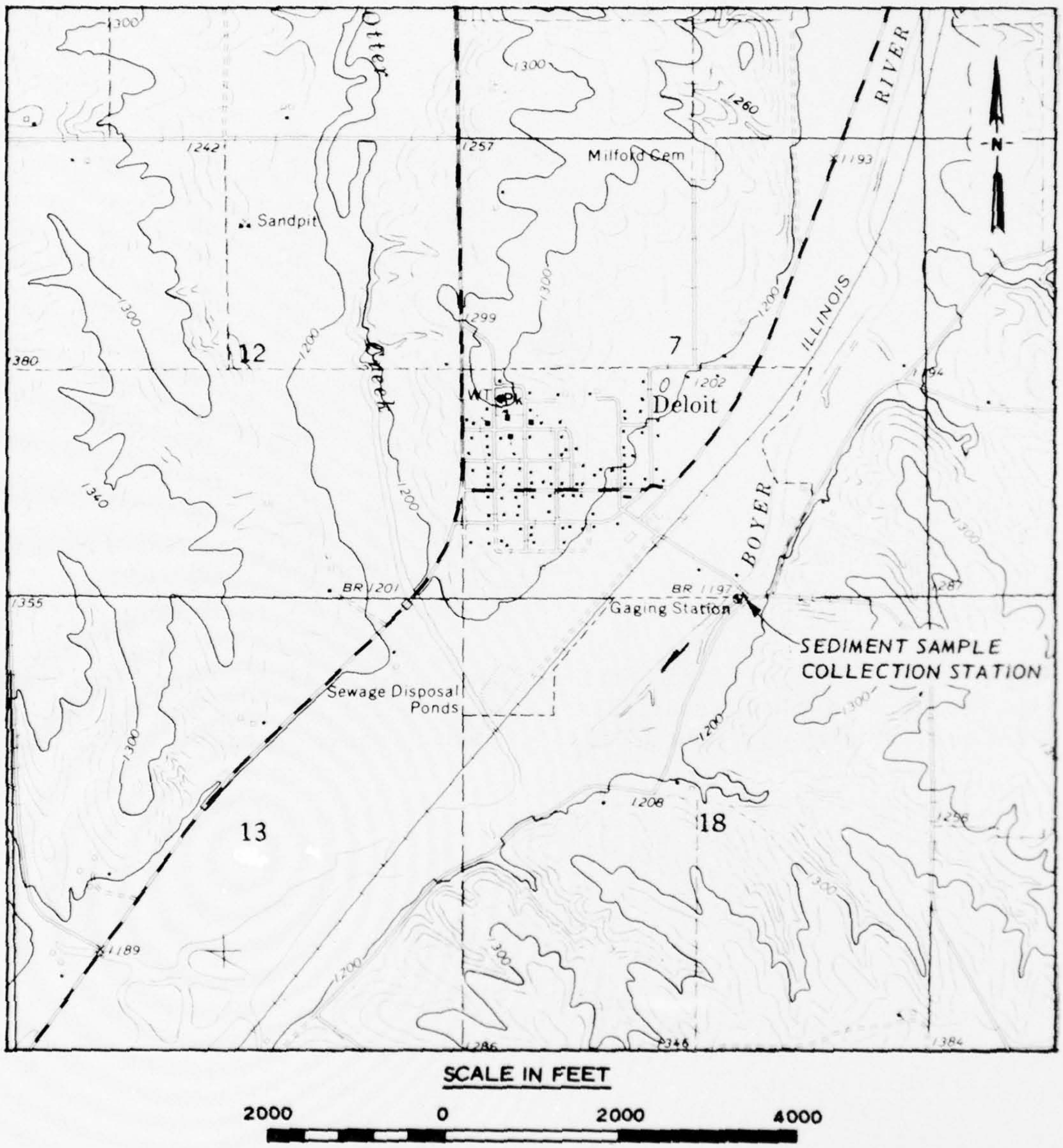

Figure A22. Site location for Deloit, Iowa, sediment sample collection station (Source: USGS Quadrangle Map for Denison, Iowa, 1971)

BOYER RIVER AT DELOIT, IOWA 6-0212.7

MEASURED SUSPENDED SEDIMENT LOAD IN TONS — 1969 WATER YEAR

	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1							32300	108	70	419	85	191
2							28800	156	60	136	72	85
3							37800	265	60	841	63	68
4							114000	151	57	871	53	57
5							129000	136	87	244	50	61
6							24800	220	117	171	49	47
7							10800	192	159	2700	51	153
8							5720	164	19500	1730	43	49
9							3930	131	1750	4340	243	19
10							2590	108	849	1070	38	17
11							1560	85	3660	634	27	28
12							1250	75	10800	456	22	26
13							1030	76	16400	355	21	19
14							973	68	2460	281	20	16
15							1260	61	1150	259	19	16
16							1640	61	622	566	20	14
17							2170	234	359	502	20	13
18							2590	421	213	641	19	12
19						9070	1260	217	102	389	19	10
20						14400	697	154	90	248	16	10
21						6770	424	126	89	169	42	9.2
22						11900	233	140	91	134	60	8.6
23						14300	175	172	4420	155	74	8.4
24						23000	145	158	17600	394	64	7.3
25						10100	126	138	6160	207	97	33
26						7050	122	137	64900	105	98	24
27						8600	165	127	15100	1770	106	18
28						8120	145	109	13300	1250	87	14
29						2280	121	95	2780	220	78	9.4
30						1490	108	85	530	145	75	4.7
31						1440		74		115	294	
						118520	405935	4444	183526	25517	2047	1048

PERIOD TOTAL 741,100

Figure A23. Example of sediment data for Deloit, Iowa (Source: Suspended Sediment in the Missouri River, Daily Record for Water Years 1965-1969, U. S. Army Engineer District, Omaha, Omaha, Nebraska, May 1972)

BEST AVAILABLE COPY

Cedar River at Cedar Rapids, Iowa

Station identification

OWDC No.: 73595

Agency station No.: 05464500

Latitude/longitude: 415814/914001

Agency reporting to OWDC: USGS

River mile: 112.0 (Mile 0 is at the confluence of the Iowa and Mississippi rivers; established by the CE about 1955.)

Site description

The sediment sample collection station on the Cedar River at Cedar Rapids, Iowa, was in operation from 1943 through 1954. The station was 500 ft downstream from the stream gaging station on the 8th Avenue Bridge (Figure A24). This is a relatively straight reach of the river between two bends. The Cedar River is not navigable for commercial traffic. Along both banks are the urban and industrial areas of Cedar Rapids. Since the program was discontinued in 1954, there has been little additional development along the upstream reaches of the stream, except for a nuclear power plant approximatley 30 miles upstream. Effluents from the plant are treated and regulated. The plant operators are required by law to discharge the same quality of water that they withdraw from the Cedar River. Banks in the vicinity of the sediment sample collection station are steep and subject to overtopping. The left bank is partially protected with a concrete wall. There are some riprap and dikes protecting both banks. A series of highway and railroad bridges and a hydroelectric plant are one-half mile upstream. The streambed material consists of limestone with some sands, and the channel gradient is 2.34 ft/mile. The discharges measured prior to the closing of the sediment station (1902-1954) were: maximum - 41,400 cfs; mean - 3,145 cfs; and minimum - 212 cfs. Diurnal fluctuations at low stages are the results of intake by the power plant upstream. The daily sediment loads of record (1943-1954) are: maximum - 245,000 tons/day; mean - 2,431 tons//day; and minimum - 1.6 tons/day.

Station chronological record

This station was established in 1943 to measure sediment loads that could be expected at a proposed CE flood control dam, which was to be built downstream from Cedar Rapids. Additionally, sediment data were needed from streams flowing through limestone and sands. A dam survey was made, but the dam was not constructed because of economic reasons. The operation of the sediment station was funded by the Iowa Geological Survey (state agency). Sample collection, laboratory analysis, data reduction, and data publication were the responsibility of the USGS Iowa District. Temperatures were collected with samples from 1944-1954; chemical analyses and specific conductance measurements were made periodically from 1944-1954.

Sample and data collection procedures

During high flows and periodically during low flows from 1943 through 1954, two 1-pt depth-integrated samples were collected daily by a paid observer and were combined for analysis. A US D-43 sampler was mounted on the 8th Avenue Bridge, 500 ft downstream from the Cedar Rapids gaging station. During low flows a US DH-59, hand-held sampler was used. Periodically, equal-transit-rate (ETR) samples were also taken. The ETR method of calculating sediment load was used to derive a correction factor for use in estimating the load with the single depth-integrated vertical. The use of these samplers and the ETR method are explained in Reference 1a.

The gaging station (established by the USGS at mile 112.7 in 1902) is still active. Discharge is computed using the rating curve for that station.

The following tabulation summarizes the gaging and recording devices used in Cedar Rapids during the period of record by the USGS and the U. S. Weather Bureau (now National Weather Service):

Period	Device Used
USGS	
26 October 1902 - 19 August 1920	Inclined staff gage

(Continued)

Period	Device Used
USGS (Continued)	
20 August 1920 - 8 October 1933	Gurley weekly water-stage recorder
? - present	Enameled staff gages
9 October 1933 - 7 November 1933	Temporary staff gage
10 November 1933 - 21 August 1934	Gurley weekly water-stage recorder
21 August 1934 - 16 July 1942	Au continuous recorder
16 July 1942 - 20 September 1949	Friez water-stage recorder
20 September 1949 - present	Stevens A-35 continuous water-stage recorder
5 May 1971 - present	Automatic digital recorder
U. S. Weather Bureau (now National Weather Service)	
? - present	Remote reading gage

Laboratory sample analysis

The sample bottles were allowed to settle at room temperature for at least three weeks. The main purpose of the laboratory analysis of the sediemnt samples is to determine concentration (parts per million) of the suspended solids. Bed-material samples are analyzed for particle size. Particle-size analyses can be made when 1 g or more of sediment is present. Analyses of dissolved solids are not made as a general rule. Procedures (and standard laboratory sheets) for determining concentration of the suspended solids and for particle-size analyses of the suspended-sediment and bed-material samples are discussed in Reference 1b. A size analysis was made on only a few samples because of the small amount of material normally found in the sediment samples.

Data reduction procedures

Information is identical to that presented for the Boyer River sediment sample collection station at Logan, Iowa, except that sediment-load computations were performed manually.

Data reporting procedures

All discharge, suspended-sediment concentration (Figure A25), particle-size, and temperature data were published annually in Reference 16. Discharge data during the period of record of the sediment station (1943-1954) and from 1955-1961 were published in Reference 12. Since 1961, these data have been published in Reference 15. Discharge data are entered in the USGS WATSTORE, an automated information retrieval system.

General information

Both the streamflow and sediment data from this station are considered to be excellent, except for those records taken during periods when ice was present; these are considered poor.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

Figure A24. Site location for Cedar Rapids, Iowa, sediment sample collection station (Source: USGS Quadrangle Map for Cedar Rapids South, Iowa, 1967)

HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS

IOWA RIVER BASIN

CEDAR RIVER AT CEDAR RAPIDS, IOWA

Suspended sediment, water year October 1953 to September 1954

Day	October: Mean discharge (cfs)	October: Suspended sediment: Mean concentration (ppm)	October: Suspended sediment: Tons per day	November: Mean discharge (cfs)	November: Suspended sediment: Mean concentration (ppm)	November: Suspended sediment: Tons per day	December: Mean discharge (cfs)	December: Suspended sediment: Mean concentration (ppm)	December: Suspended sediment: Tons per day
1	718			694			580		
2	802			706			924		
3	730			694			768		
4	706			580			845		
5	706			670			871		
		63	127		43	79			
6	754			718			938		
7	838			730			938		
8	670			658			980	18	43
9	766			706			1,020		
10	790			682			952		
11	730			718			994		
12	706			694			832		
13	658			730			900		
14	670			718			800		
15	646			694			480		
					59	116			
16	718	63	117	720			390	26	28
17	694			720			330		
18	670			756			320		
19	694			684			455		
20	682			832			648		
21	706			832			756		
22	670			845			696		
23	766	310	641	845			696		
24	670	66	119	845			525		
25	718			910			515		
					21	48		19	33
26	754			845			637		
27	754	52	100	924			672		
28	694			819			672		
29	610			910			660		
30	742			708			660		
31	706			-	--	--	672		
Total	22,138	--	4,134	22,587	--	2,430	22,126	--	1,138
	January			February			March		
1	602			400			952		
2	614			402			938	20	50
3	648			411			897		
4	696			445			428		
5	648			475			465		
		14	23		15	20		25	35
6	591			495			515		
7	626			535			650		
8	602			545			910		
9	620			525			858	33	76
10	560			602			793		
11	500			626			756		
12	530			640			819	68	147
13	480			550			832		
14	445			500			780		
15	450			744	15	28	768		
		37	47					26	50
16	480			924			696		
17	500			871			684		
18	440			1,120			637		
19	411			1,060			756		
20	420			910			793		
					32	87		52	114
21	430			980			884		
22	390			952			980		
23	368			1,020			1,080		
24	400			1,050			1,090		
25	420			966			1,200		
		29	31		23	65		59	173
26	390			1,080			1,240		
27	377			1,020			1,080		
28	410			1,080			1,040		
29	400			--	--	--	994		
30	402			--	--	--	871	36	86
31	410			--	--	--	897		
Total	15,260	--	1,041	20,928	--	1,243	26,283	--	3,107

Figure A25. Example of sediment data for Cedar Rapids, Iowa (Source: Quality of Surface Waters in the United States, 1954, USGS, Iowa City, Iowa (sheet 1 of 2)

IOWA RIVER BASIN--Continued

CEDAR RIVER AT CEDAR RAPIDS, IOWA--Continued

Suspended sediment, water year October 1953 to September 1954--Continued

Day	April			May			June		
	Mean discharge (cfs)	Suspended sediment		Mean discharge (cfs)	Suspended sediment		Mean discharge (cfs)	Suspended sediment	
		Mean concentration (ppm)	Tons per day		Mean concentration (ppm)	Tons per day		Mean concentration (ppm)	Tons per day
1......	806			5,220	954	s 14,300	5,290	1,080	15,400
2......	910	57	129	5,040	752	10,200	5,040	680	9,250
3......	819			5,760	625	9,720	5,760	505	7,850
4......	806			6,120	495	8,180	6,440	542	9,420
5......	793	73	sa 190	6,660	472	8,490	5,580	320	4,820
6......	980	82	217	7,390	472	9,420	4,830	262	3,420
7......	1,020	100	275	6,840	290	5,360	4,340	255	2,990
8......	952	84	216	6,120	215	3,550	3,850	205	2,130
9......	1,090	76	224	4,860	126	1,650	3,250	146	1,280
10......	1,040	60	168	4,060	123	1,350	3,340	216	1,950
11......	980			3,570	111	1,070	3,380	404	3,690
12......	952			3,070	107	887	3,190	284	2,450
13......	952	62	158	2,960	116	927	3,960	478	5,110
14......	884			2,720	130	955	4,100	626	6,930
15......	1,040	90	253	2,480	128	857	2,960	322	2,570
16......	1,190	93	299	2,300	119	739	2,690	190	1,380
17......	1,310	67	237	2,110	117	667	2,600	134	941
18......	1,260	66	225	1,950	100	527	2,640	136	969
19......	1,130	61	186	1,720	93	432	3,960	250	2,670
20......	1,180	86	274	1,660	87	390	5,400	382	5,570
21......	1,450	108	423	1,610	81	352	7,690	845	17,500
22......	1,360	82	301	1,500	72	292	10,300	1,310	36,400
23......	1,260	104	354	1,520	69	283	14,000	1,380	52,200
24......	1,450	180	sa 820	1,470	52	206	21,400	965	55,800
25......	2,410	478	3,110	1,420	67	257	34,900	928	87,400
26......	2,130	382	2,200	1,400	69	261	40,000	612	66,100
27......	2,070	160	894	1,360	100	367	31,900	352	30,300
28......	2,110	148	843	2,050	87	482	22,100	182	10,900
29......	2,130	119	684	2,220	120	719	15,100	172	7,010
30......	2,300	129	801	2,500	110	743	11,000	210	6,240
31......	--	--	--	2,880	122	949	--	--	--
Total	38,764	--	14,342	102,540	--	84,582	290,990	--	460,640
	July			August			September		
1......	8,530	152	3,500	1,440			5,400		
2......	7,390	150	2,990	1,610			4,340	127	1,510
3......	6,480	193	3,380	1,760			3,510		
4......	5,760	94	1,460	1,740	71	317	3,100		
5......	5,400	103	1,500	1,720			2,690	114	891
6......	5,400	115	1,680	1,660			2,520		
7......	5,040	144	1,960	1,520			2,320	68	424
8......	4,690	112	1,420	1,470			2,090		
9......	4,240	73	836	1,400	44	171	2,010		
10......	3,920	77	815	1,370			1,990	72	387
11......	3,540	80	765	1,260			1,970		
12......	3,250	75	658	1,190			1,790		
13......	2,960	72	575	1,280			1,740		
14......	2,640	90	642	1,220			1,700	57	264
15......	2,570	85	590	1,250	37	126	1,640		
16......	2,370	71	454	1,310			1,610		
17......	2,110	83	473	1,300			1,630		
18......	2,010	94	510	3,640	323	s 4,160	1,590		
19......	1,950			2,410	382	2,490	1,550	55	233
20......	1,870	80	408	1,720	248	1,150	1,500		
21......	1,910			1,500			1,520		
22......	1,830			1,550	121	498	1,480		
23......	1,760			1,500			1,400		
24......	1,720			1,500	52	219	1,470		
25......	1,740	87	405	1,680			1,420	56	209
26......	1,740			6,120	240	sa 4,600	1,340		
27......	1,660			7,960	482	10,400	1,260		
28......	1,570			7,960	317	6,810	1,300		
29......	1,470	84	342	7,390	296	5,910	1,590	78	335
30......	1,570			7,390	282	5,630	1,630	68	299
31......	1,420			6,660	208	3,740	--	--	--
Total	100,510	--	29,233	83,480	--	50,011	61,100	--	13,296

Total discharge for year (cfs-days).......... 806,706

Total load for year (tons).......... 665,197

s Computed by subdividing day.

a Computed from partly estimated concentration graph.

Figure A25. (sheet 2 of 2)

Delaware River Below Perry Dam, Kansas

Station identification

OWDC No.: 67967

Agency station No.: 166-7

Latitude/longitude: 390652/952533

Agency reporting to OWDC: CE

River mile: 5.8 (Mile 0 is at the confluence of the Delaware and Kansas rivers at mile 64.5 on the Kansas River; established by the CE in 1969.)

Site description

The station is at the outlet structure of Perry Dam, 4.5 miles northwest of Perry, Kansas, and 5.8 miles above the mouth of the Delaware River (Figure A26). Perry Dam is a compacted earth-fill dam 7750 ft long and has a maximum head above the streambed of 120 ft. Construction at the dam site started in 1963. Because of flooding in the Kansas River Basin, the project was placed in emergency operation in 1969 but was formally dedicated in 1970. The stream is not navigable for commercial traffic in this reach. The bed material downstream from the dam consists of sands, and the gradient is 0.8 ft/mile. Riprap has been placed on the banks for 150 ft downstream from the dam. The land in the vicinity of the station is used exclusively for agriculture. Annual soil loss due to erosion in this area is 1,000-3,000 tons/square mile. The discharges of record (1969 to the present) are: maximum - 10,000 cfs; mean - 1,383 cfs; minimum - 0 cfs (no flow for many days in 1970-1973). The flow is completely regulated by Perry Dam. The discharge is determined by the head and gate openings. The sediment loads of record (1969 to the present) are: maximum - 9,072 tons/day; mean - 124 tons/day; and minimum - 0 tons/day.

Station chronological record

The sediment sample collection station was established by the CE Kansas City District (KCD) in January 1969 to monitor the sediment passing through the outfall of the dam. The samples were collected by the

CE personnel and were analyzed in the KCD Laboratory until May 1973, by the CE Missouri River Division Laboratory in Omaha from May 1973 to April 1974, and from that date to the present by the USGS Kansas District in Lawrence. The resulting data are reduced and reported by the KCD. Prior to 1969, there was no data collection station at this site.

Sample and data
collection procedures

The sampling procedure consists of taking one grab sample a week with a milk bottle near the surface. Stage is measured continuously at the gated outflow structure using a Stevens graphical recorder driven by a bubble gage. A Stevens graphical recorder-float type gage is used for measuring reservoir stage.

Laboratory sample analysis

Information for the period of record of the station is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

Information for the period of record of the station is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Water discharge has been recorded since 21 March 1969 and is reported in Reference 10. Suspended-sediment load has been measured since 1 January 1969 and is published in Reference 11. Figures A27 and A28 show samples of sediment and discharge data reported for this station.

General information

Sediment records for this station are considered good.

Additional information can be obtained from: U. S. Army Engineer District, Kansas City, Hydrologic Engineering Branch, Water Control Section, 700 Federal Building, 601 East 12th Street, Kansas City, Missouri 64106.

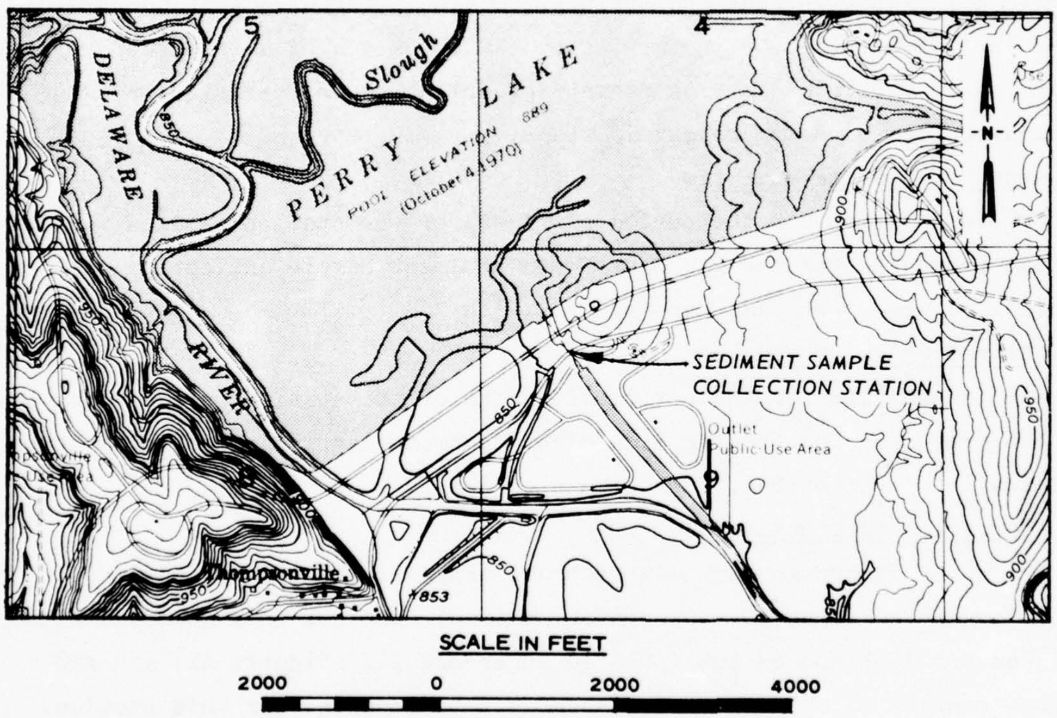

Figure A26. Site location for sediment sample collection station below Perry Dam, Kansas (Source: USGS Quadrangle Map for Perry, Kansas, 1949)

DELAWARE RIVER AT PERRY RESERVOUR, KANSAS

SUSPENDED SEDIMENT LOAD - TONS | WATER YEAR OCT 1968 - SEP 1969

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1				10	14	5,160	7	670	27	7	1	4
2				8	12	2,633	9	1,893	14	5	1	4
3				8	12	1,053	10	527	14	5	1	4
4				8	12	635	8	93	14	5	1	4
5				8	12	474	7	759	14	4	1	4
6				8	12	356	5	540	10	4	1	4
7				8	2,051	378	5	209	8	5	1	4
8				8	2,349	359	4	54	9	7	1	4
9				8	2,187	388	3	234	8	8	1	4
10				8	2,066	365	3	270	8	10	1	4
11				8	1,944	365	3	68	12	11	1	4
12				8	1,823	267	3	14	12	10	1	4
13				8	1,620	219	4	14	373	7	1	4
14				8	1,053	367	5	14	397	5	1	3
15				8	692	516	5	14	54	4	1	2
16				1	540	365	10	14	6	2	1	2
17				24	562	270	8	14	4	1	1	1
18				41	338	230	8	14	4	1	1	1
19				41	284	169	5	14	8	1	1	1
20				41	230	128	4	22	59	1	3	2
21				41	230	76	3	54	124	1	4	3
22				41	230	53	3	37	270	1	3	4
23				41	243	32	1	296	270	1	3	4
24				24	243	15	1	864	135	1	2	4
25				16	4,536	27	1	864	253	1	2	3
26				14	8,089	19	1	166	42	1	1	2
27				14	9,072	4	1	95	2	1	2	2
28				14	8,845	3	1	27	3	1	3	2
29				19		4	150	27	3	1	5	2
30				10		5	1,154	27	4	1	5	2
31				14		6		27		1	5	
				518	49,301	14,941	1,432	7,935	2,161	114	57	92

YEARLY TOTAL - 76,551 TONS

Figure A27. Example of sediment data for station below Perry Dam (Source: Suspended Sediment in the Missouri River, Daily Record for Water Years 1965-1969, U. S. Army Engineer District, Omaha, Omaha, Nebraska, May 1972)

KANSAS RIVER BASIN

6-8909. Delaware River below Perry Dam, Kans.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1							46	3,270	500	8,200	24	24
2							46	2,650	500	4,710	24	24
3							46	585	500	50	24	24
4							46	5,350	500	50	24	24
5							50	9,750	430	50	24	24
6							51	6,770	300	50	24	24
7							52	1,430	210	50	24	24
8							52	2,360	150	50	24	24
9							52	4,760	150	50	24	24
10							52	2,400	150	51	24	24
11							53	660	150	51	24	24
12							53	495	2,610	51	24	24
13							53	500	4,350	51	24	24
14							53	500	1,640	51	24	24
15							53	500	500	37	24	24
16							54	500	150	24	24	24
17							54	500	150	24	24	24
18							55	500	155	24	24	24
19							56	665	640	24	57	26
20							56	1,000	3,040	24	24	30
21						230	56	855	4,950	24	24	30
22						33	37	1,660	4,960	24	24	30
23						54	56	6,670	4,980	24	24	30
24						86	40	7,880	7,470	24	24	30
25						115	28	4,850	8,760	24	24	30
26						84	28	1,380	7,950	24	24	30
27						44	30	660	8,080	24	24	30
28						45	1,000	500	8,100	24	24	30
29					------	45	3,300	500	8,140	24	24	30
30					------	45	3,700	500	8,180	24	24	30
31		------			------	45	------	500	------	24	24	------
TOTAL							9,308	71,100	88,345	13,936	777	788
MEAN							310	2,294	2,945	450	25.1	26.3
MAX							3,700	9,750	8,760	8,200	57	30
MIN							28	495	150	24	24	24
AC-FT							18,460	141,000	175,200	27,640	1,540	1,560

Figure A28. Example of discharge data station below Perry Dam, Kansas (Source: Water Resources Data for Kansas, 1969, U. S. Government Printing Office, Washington, D. C.)

Des Moines River at St. Francisville, Missouri

Station identification

OWDC No.: 91624

Agency station No.: 05490600

Latitude/longitude: 402745/913400

Agency reporting to OWDC: USGS

River mile: 15.1 (Mile 0 is at the confluence of the Des Moines and Mississippi rivers; established by the CE about 1935.)

Site description

The sediment-sampling station and the gaging station for the Des Moines River at St. Francisville, Missouri, are at river mile 15.1 on the Clark County, Missouri, Highway Toll Bridge (Figure A29). The banks in the vicinity of the sampling station are unprotected. There are artificial levees paralleling both the left (or Iowa) and the right (or Missouri) bank downstream from the sampling station. The distance from the right bank to the wooded bluff line ranges from 0 to 0.4 miles. The floodplain of the Des Moines River extends 3 miles from the left bank in the vicinity of the sampling station and is mainly an agricultural area. Downstream from St. Francisville the Des Moines River flows eastward across its floodplain for 3 miles and then southward when it reaches its Iowa bluff line. There is virtually no industry upstream of the station, and the Des Moines River is not navigable to commercial traffic through this reach. The streambed consists principally of fine sands, but there are also some coarser sands and gravels. Channel gradient of this reach is approximately 1.1 ft/mile. Although the stream-gaging station at St. Francisville has been in operation since 2 July 1946, no discharge data are readily available. The next station upstream of St. Francisville is Keosauqua, Iowa (mile 51.3). Only a few minor tributaries enter the Des Moines River between Keosauqua and St. Francisville, so the gaging record at Keosauqua is considered to be the same as that of St. Francisville. The discharges of record at Keosauqua (May 1903 to July 1906, April to December 1910, and August 1911 to the present) are:

maximum - 146,000 cfs; mean - 5,514 cfs; and minimum - 40 cfs. The flows have been affected by the Red Rock Reservoir since 12 March 1969. The 10 suspended-sediment loads measured during the period of record (November 1974 to the present) range from 141 tons/day to 99,200 tons/day. The number of measurements are too few to provide a valid mean daily suspended-sediment load for this station.

Station chronological record

This station was established as a sediment sample collection station by the USGS in November 1974 at an established gaging and water-quality sampling station. As an integral part of the National Stream Quality Accounting Network (NASQUAN), its purpose is to monitor sediment loads carried by the Des Moines River into the Mississippi River. Chemical and biological analysis have been run on sediment samples collected at this station since August 1967. Sample collection, sample laboratory analysis, data reduction, and data publication are the responsibility of the USGS Missouri District.

Sample and data collection procedures

No discharge measurements are made prior to collecting samples; instead, the field party takes a gage-height reading with a Type A wire-weight gage mounted on the St. Francisville Bridge and uses a rating curve for this station to determine discharge.

Samples are taken monthly with a US P-61 sampler attached to a mobile crane. A member of the field party drives the crane along the bridge and samples five verticals at fixed intervals using the equal-transit-rate (ETR) method. The US P-61 sampler and the ETR method are discussed in Reference 1a.

The Rock Island District (RID) owns the Type A wire-weight gage mounted on the St. Francisville Bridge. Throughout the period of record (2 July 1946 to the present), this gage or one identical to it has been used to measure river stage at this station. Each day, a paid observer reads the stream gage for the RID, takes a specific conductance sample, and measures water temperature for the USGS Missouri District.

Laboratory sample analysis

Sediment analysis is the responsibility of the USGS Missouri District. The monthly samples collected on the second and fourth verticals are taken to the USGS Soils Laboratory in Rolla, Missouri. Particle-size and suspended-sediment concentration analyses are run on each sample, and these values are later mathematically composited to obtain a single set of values for one day of sampling. The procedures used to analyze sediment samples are discussed in Reference 1b. Chemical and biological analyses are handled by the USGS Central Laboratory in Doraville, Georgia.

Data reduction procedures

The soils laboratory computes the suspended-sediment concentrations. The USGS Missouri District personnel punch these values, with the measured discharge values, into computer cards and enter them via a remote terminal into the USGS computer in Reston, Virginia. The USGS Water Resources Division (WRD) computer programs are used to compute sediment loads. The final output of these computer program becomes part of the USGS WRD data files. Reference 1c contains a discussion of the data reduction procedures used. The USGS Central Laboratory in Doraville, Georgia, also enters the results into the USGS WRD files.

Data reporting procedures

No discharge data for the St. Francisville, Missouri, gaging station have ever been published in any form by the RID; however, discharge data for Keosauqua, Iowa, were published prior to 1961 in Reference 12, and since 1961 these data have been published in Reference 15. Chemical and biological data have been published since 1967 in Reference 17. Beginning with the volume to be published in 1976 for water year 1975, temperatures, conductivity, particle-size distributions, suspended-sediment concentrations, and biological constituents will be published in Reference 18. No sample sediment load data are available. Daily values for temperature and conductivity, and discharge are added periodically to the Environmental Protection Agency's STORET System by the USGS personnel at Reston, Virginia. These values, as well as data on chemical constituents, biological constituents, and the sediment parameters, are in the USGS WRD Water-Quality Files.

General information

Although the number of samples collected at this station since 1974 are not sufficient to draw any reasonable conclusions about sediment loads in this reach of the Des Moines River, this station is part of the nationwide NASQUAN network and will be operated indefinitely. The NASQUAN program is committed to fulfilling the long-term objectives of detection of trends in water quality.

Further information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, P. O. Box 340, 103 West Tenth Street, Rolla, Missouri 65401.

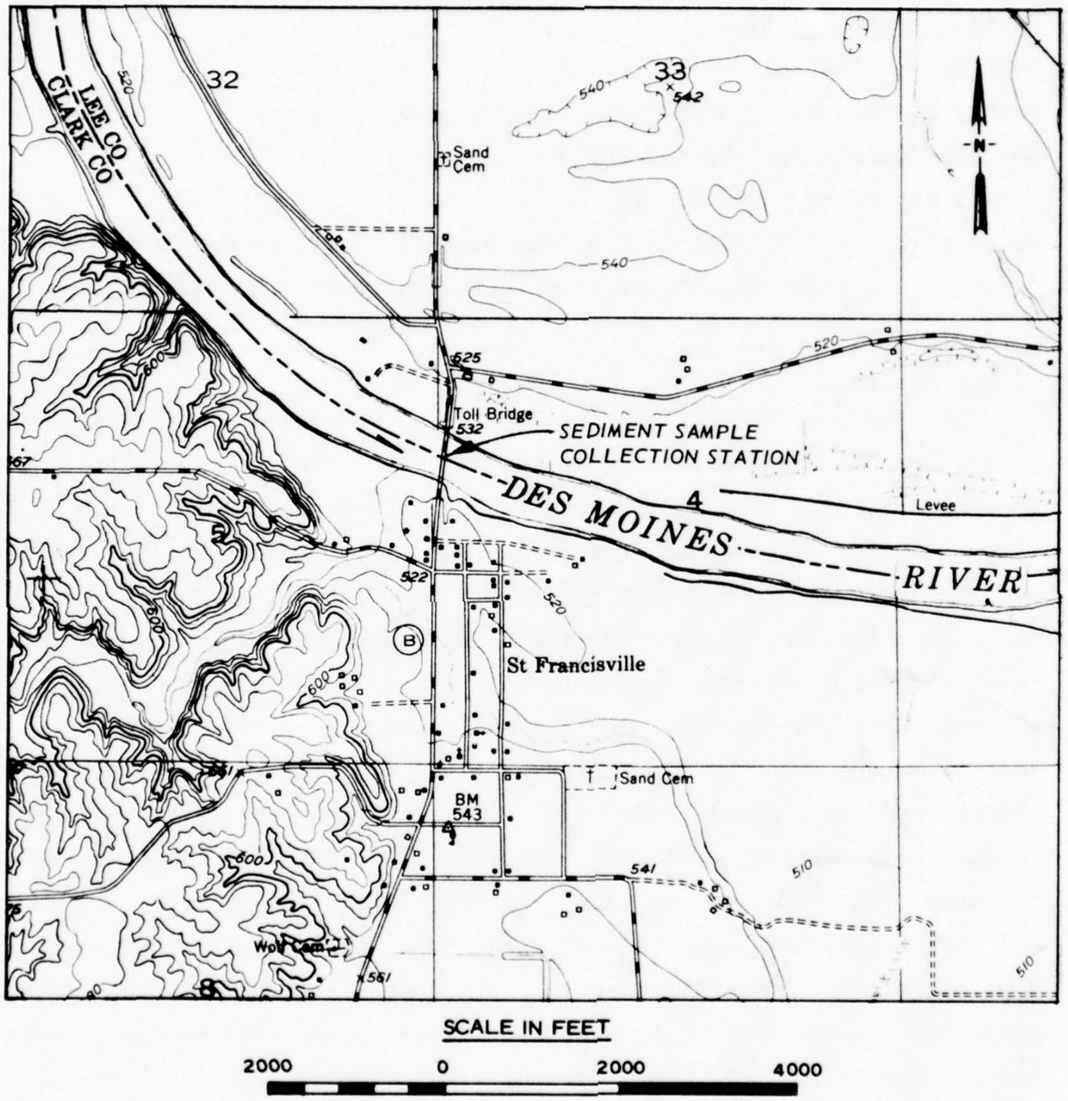

Figure A29. Site location for St. Francisville, Missouri, sediment sample collection station (Source: USGS Quadrangle Map for Wayland, Missouri-Iowa, 1949)

Des Moines River Near Tracy, Iowa

Station identification

OWDC No.: 54605

Agency station No.: None, only name is used by agency

Latitude/longitude: 411655/925130

Agency reporting to OWDC: CE

River mile: 130.4 (Mile 0 is at the confluence of the Des Moines and Mississippi rivers; established by the CE about 1935.)

Site description

The sediment and gaging stations are on an abandoned railroad bridge on the Des Moines River, 0.8 mile east of Tracy, Iowa (Figure A20). They are 11.9 miles downstream from the Red Rock Reservoir (constructed in March 1969) on a relatively straight reach of the river. There are steep natural banks upstream from the station. Farming dominates the economy of this region, and there is virtually no commercial or industrial activity. Several minor tributaries enter the Iowa River between the sediment station and the reservoir. The stream is not navigable for commercial traffic in this reach. The bed material consists of sands and silts; the approximate channel gradient of the river in the reach is 1 ft/mile. Flows are influenced by the Red Rock Reservoir, which began operation on 12 March 1969. For the period of record prior to the construction of Red Rock Reservoir (March 1920 to March 1969, the discharges measured were: maximum - 155,000 cfs; mean - 4,339 cfs; and minimum - 40 cfs. Since the construction of Red Rock Reservoir (March 1969 to the present), the discharges measured are: maximum - 30,000 cfs; mean - 5,892 cfs; and minimum - 300 cfs. Estimated daily suspended-sediment loads during the period of record (water years 1941-1967) are: maximum - 350,000 tons/day; mean - 22,000 tons/day; and minimum - 0.8 ton/day. No sediment load data are available for years after 1967.

Station chronological record

The sediment sample collection station was established by the CE in 1940 to measure sediment loads and to evaluate the need for a sediment

trap (Red Rock Reservoir). Sample collection is a cooperative effort of the USGS Iowa District and the CE Rock Island District (RID). Since 1967, suspended-sediment samples have been analyzed by the USGS Sedimentation Laboratory, Iowa City, Iowa; prior to this date, the analysis was performed by the RID Laboratory. Data reduction is the responsibility of the RID. No sediment data have ever been published in any form. However, daily discharge values for each water year are published by the USGS.

Sample and data collection procedures

Depth-integrated, suspended-sediment samples, as well as temperature and unofficial gage-height readings, have been collected daily (except on those days when the ice cover was too thick for sampling) by USGS-paid observers. Prior to 1950, a device developed by the RID, known as the "Rock Island Sampler," was used (Reference 18). This was a nozzle-fed, bottleless sampler. When the cavity of the sampler was filled, the sampler was agitated and samples were poured into bottles. Since sediment particles always remained inside the sampler, the results obtained were unreliable; a factor of 10 percent was always added to suspended-sediment concentrations obtained with the Rock Island Sampler. Since 1950, the US D-49 sampler has been used; Reference 3 contains detailed instructions for operation of this sampler.

River stage data have been collected daily since March 1920 by the USGS at its Tracy gaging station. A staff gage was used prior to 1940, a Type A wire-weight gage from 1940 to 1952, a Canfield wire-weight gage from 1952 to 1960, and a Stevens A-35 recorder since 1960.

Laboratory sample analysis

The RID operated its own sediment laboratory and analyzed samples until 1967. Since 1967, the USGS laboratory in Iowa City, Iowa, has handled analysis of sediment samples. The procedures employed by both agencies for running suspended-sediment concentrations were identical. The bottom-withdrawal-tube method was used for obtaining particle-size distribution data by both agencies prior to 1971, and since 1971, the USGS has used the visual-accumulation tube for this purpose. All

laboratory procedures are discussed in Reference 1b.

Data reduction procedures

Until 1950, when the Rock Island Sampler was in use, 10 percent was added to the suspended-sediment concentration values, but this adjustment was eliminated in 1950. Prior to 1968, all computations of suspended-sediment load were performed manually, and no attempt was made to interpolate missing sediment concentration values. Since 1968, the suspended-sediment concentration data and daily average flow rates have been punched into computer cards and input to a computer program (documented in Reference 19), which computes daily suspended-sediment loads. This program is capable of handling interpolation of up to 29 consecutive days of missing suspended-sediment concentration records, provided discharges were obtained on those days. The program, however, will not attempt to interpolate suspended-sediment concentrations for more than 29 consecutive days of missing records.

Data reporting procedures

The daily suspended-sediment load values have never been published. The RID, however, is attempting to obtain computer printouts (for in-house use at present) of its data, at least as far back as 1968. An example printout is shown in Figure A31. Daily discharge values are published by the USGS in Reference 15.

General information

Information concerning the sediment sampling station on the Des Moines River near Tracy, Iowa, can be obtained from: U. S. Army Engineer District, Rock Island, Hydraulics Section, Clock Tower Building, Rock Island, Illinois 61201.

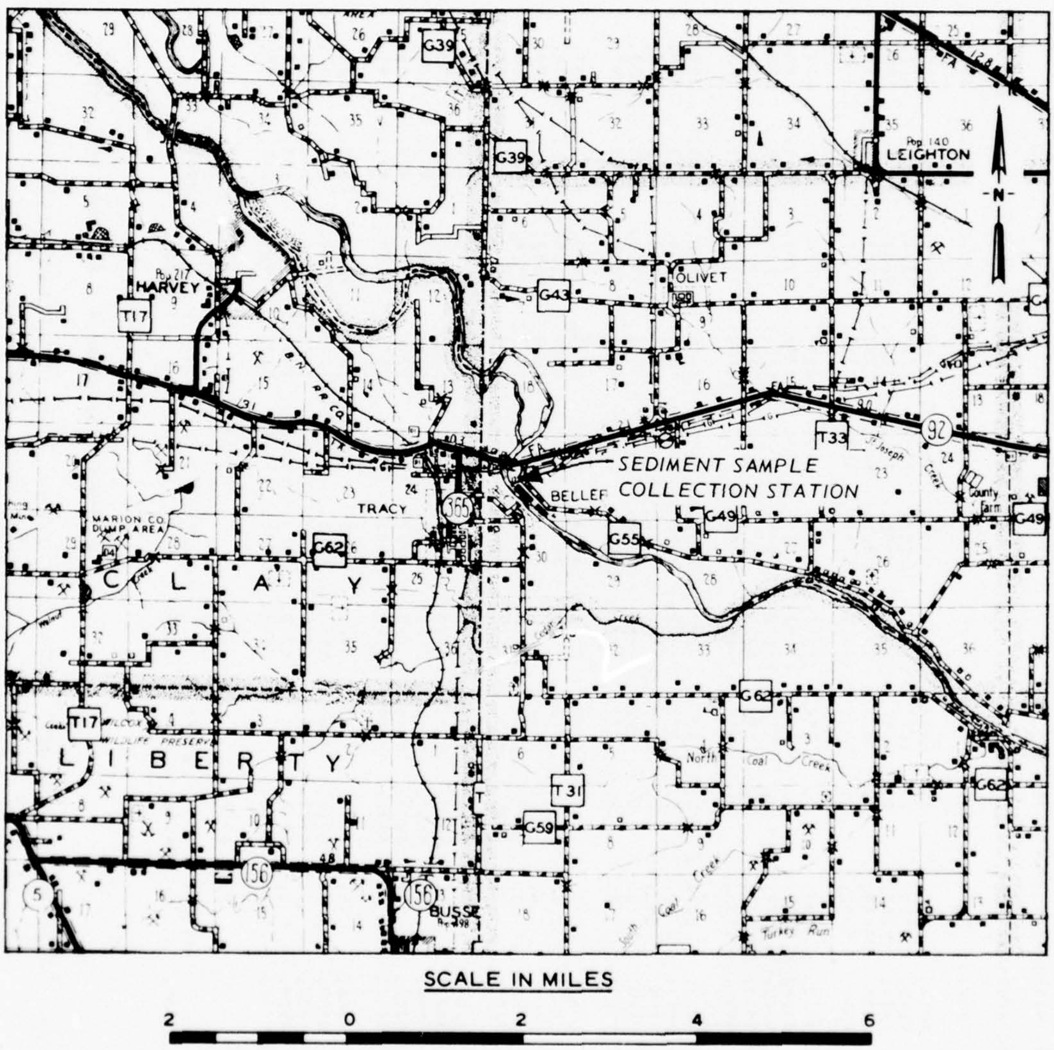

Figure A30. Site location for Tracy, Iowa, sediment sample collection station (Source: Mahaska and Marion Counties, Iowa General Highway and Transportation Maps, Iowa Department of Transportation, Ames, Iowa, 1974)

31 MAR 1976 PETERSON

DES MOINES RIVER NEAR TRACY IOWA

DAILY SUSPENDED SEDIMENT LOAD

WATER YEAR 1974

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1	8667.	5618.	4690.	0.	6972.	4650.	2109.	9807.	4753.	2571.	1824.	458.
2	5510.	5190.	4511.	0.	7127.	4847.	2002.	7067.	3377.	2393.	1943.	480.
3	7067.	6434.	7256.	0.	6457.	5917.	3486.	7161.	3064.	9683.	1852.	795.
4	9127.	5836.	4888.	0.	4422.	7205.	25801.	5443.	2543.	6933.	2119.	290.
5	7232.	4596.	5096.	0.	2114.	13929.	15765.	4683.	2324.	3737.	1755.	199.
6	3959.	2983.	4783.	0.	859.	18235.	6680.	4821.	4098.	2816.	1142.	230.
7	3119.	4616.	2283.	0.	486.	14503.	4868.	3331.	4842.	1961.	1251.	196.
8	2561.	5625.	1179.	0.	225.	11102.	5808.	3272.	28467.	2546.	1082.	158.
9	2627.	3454.	1277.	0.	251.	6296.	8273.	3120.	32885.	2400.	766.	181.
10	3467.	2430.	1100.	0.	485.	5422.	5752.	3150.	15402.	2924.	708.	193.
11	7526.	4032.	876.	0.	487.	5047.	5712.	3158.	5055.	2888.	689.	229.
12	5628.	3663.	1016.	0.	571.	4422.	4458.	3465.	3319.	3294.	655.	484.
13	6957.	2355.	2199.	0.	1010.	5055.	5711.	3520.	3756.	2519.	812.	343.
14	5848.	1945.	0.	0.	943.	5767.	13739.	5862.	3511.	2500.	1045.	238.
15	4544.	1809.	0.	0.	731.	6827.	18925.	6204.	6411.	2528.	1362.	197.
16	3419.	1623.	0.	0.	1077.	9889.	4774.	5482.	5455.	2483.	2240.	257.
17	5755.	1798.	0.	0.	612.	7665.	3532.	29063.	4607.	2168.	1011.	259.
18	8699.	1954.	0.	0.	631.	5216.	4982.	47432.	4672.	2632.	736.	274.
19	3642.	1763.	0.	1784.	1608.	4774.	5631.	30722.	22050.	2704.	737.	216.
20	4304.	2237.	0.	1926.	2623.	4132.	5991.	37917.	30825.	3029.	564.	136.
21	3741.	3065.	0.	3234.	3702.	4075.	7923.	6846.	9945.	3334.	464.	125.
22	2374.	3606.	0.	3245.	4250.	3918.	9950.	2687.	11535.	3234.	416.	132.
23	1991.	3594.	0.	4367.	5301.	3111.	8534.	1612.	5654.	2636.	450.	111.
24	1944.	4300.	0.	3904.	3090.	1440.	5787.	3112.	2314.	2376.	409.	84.
25	2128.	3458.	0.	3439.	2768.	1522.	4801.	4501.	2371.	2736.	610.	92.
26	1869.	4366.	0.	4097.	1760.	1471.	4115.	5738.	1879.	2665.	678.	113.
27	2391.	6039.	0.	6920.	2326.	1510.	6088.	7987.	1702.	2142.	637.	117.
28	2701.	4638.	0.	4705.	4064.	1735.	7871.	5972.	1777.	1921.	549.	109.
29	3791.	4524.	0.	4804.		1742.	31057.	15746.	2472.	1784.	443.	103.
30	2657.	5331.	0.	6086.		3094.	22946.	11301.	2872.	1999.	541.	97.
31	4363.		0.	6470.		2932.		5468.		1697.	472.	
	139806.	112885.	41154.	54981.	66951.	177453.	263068.	295649.	233934.	91235.	29962.	6896.

YEARLY TOTAL = 1513975. TONS

TOTAL YEARLY DISCHARGE = 7377520. ACRE FEET

Figure A31. Example of sediment data for Tracy, Iowa (printout provided by U. S. Army Engineer District, Rock Island)

Floyd River at James, Iowa

Station identification

OWDC No.: 67621

Agency station No.: 06600500

Latitude/longitude: 423436/961843

Agency reporting to OWDC: USGS

River mile: 9.5 (Mile 0 is at the confluence of the Floyd and Missouri rivers; established by the USGS in 1968.)

Site Description

The station was 0.2 mile east of James, Iowa, on Plymouth County Highway Bridge C-70, which crosses the Floyd River 15.1 miles downstream from the confluence of the Floyd and the west branch of the Floyd (Figure A32). The stream is not navigable for commercial traffic. This reach is relatively straight, and the streambed is composed of sand, silt, and gravel and is subject to severe degradation during periods of high flow. There is no bank protection, and the banks are overtopped during high flow. The channel gradient through this reach is approximately 4.4 ft/mile. The land in the vicinity of the station is used almost exclusively for agriculture. Annual soil loss due to erosion up-from the station is 250-300 tons/square mile. The discharges of record (4 December 1934 to the present) are: maximum - 71,500 cfs; mean - 180 cfs; and minimum - 1.0 cfs. The sediment loads of record (1968 to 1973) are: maximum - 105,000 tons/day; mean - 1,230 tons/day; and minimum - 0.2 ton/day.

Station chronological record

This station was established for the Iowa Geological Survey (state agency) by the USGS Iowa District on 1 October 1968 and was operated until 30 September 1973, at which time the sediment regime in this segment of the Floyd River was considered to be sufficiently well defined. Prior to establishment of the station, the channel below James, Iowa, had been straightened, resulting in a steeper gradient between the station and the confluence of the Floyd and Missouri rivers. The station

was established to evaluate the effect of the channel modification. During the period of operation, the USGS Iowa District collected and analyzed the samples and reduced and reported the data.

Sample and data
collection procedures

Collection of sediment samples on a daily basis began on 1 October 1968. A paid observer collected daily sediment samples during normal flow periods and at more frequent intervals during a high flow. All samples were depth-integrated and obtained with either a US D-43 sampler or a brass bucket. The brass-bucket sampler was used to obtain samples during the winter. A 1-pt bottle sample was obtained, except for periods of high flow when two-bottle samples were taken. Temperature and conductivity observations are made on all samples.

Gaging at James, Iowa, began on 4 December 1934 at the same location as the sediment station (mile 9.5). The following tabulation presents the gaging and recording devices used during the period of record by the USGS and the National Weather Service:

Period	Device Used
	USGS
4 December 1934 - 10 September 1938	Canfield wire-weight gage
11 September 1938 - 8 June 1953	Recording gage
8 Jun 1953 - present	Type A wire-weight gage
16 November 1953 - present	Stevens A-35 water-stage recorder (driven by manometer)
13 October - present	Digital punched-tape water-stage recorder (driven by manometer)
	National Weather Service
? - present	Telemark (driven by the USGS manometer)

Laboratory sample analysis

Information is identical to that presented for the sediment sample collection station on the Cedar River at Cedar Rapids, Iowa.

Data reduction procedures

The concentration values obtained at the station are plotted on a gage-height chart, and a smooth concentration curve is drawn between the points. The average is used as the mean daily concentration. Daily sediment loads are computed by multiplying the product of the mean daily discharge and mean concentration by 0.0027 to convert to tons per day. On 64 days of rapidly changing water discharge and concentration, the graphs were subdivided and the total sediment discharge for the day was computed by averaging sediment discharge for appropriate intervals of a day. Sediment for each water year is computed with the USGS Water Resources Division sediment computer program W-4252.

Data reporting procedures

Published and unpublished data for the period of record are on file at the USGS Iowa District. Daily suspended-sediment load data are published in Reference 14. Figure A33 is an example of the published data. Discharge data have been published on a daily basis from 1 December 1934 to the present in Reference 12 (years prior to 1961) and in Reference 15 (1961 to the present).

General information

Sediment records are considered to be good except for the winter periods, which are poor.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

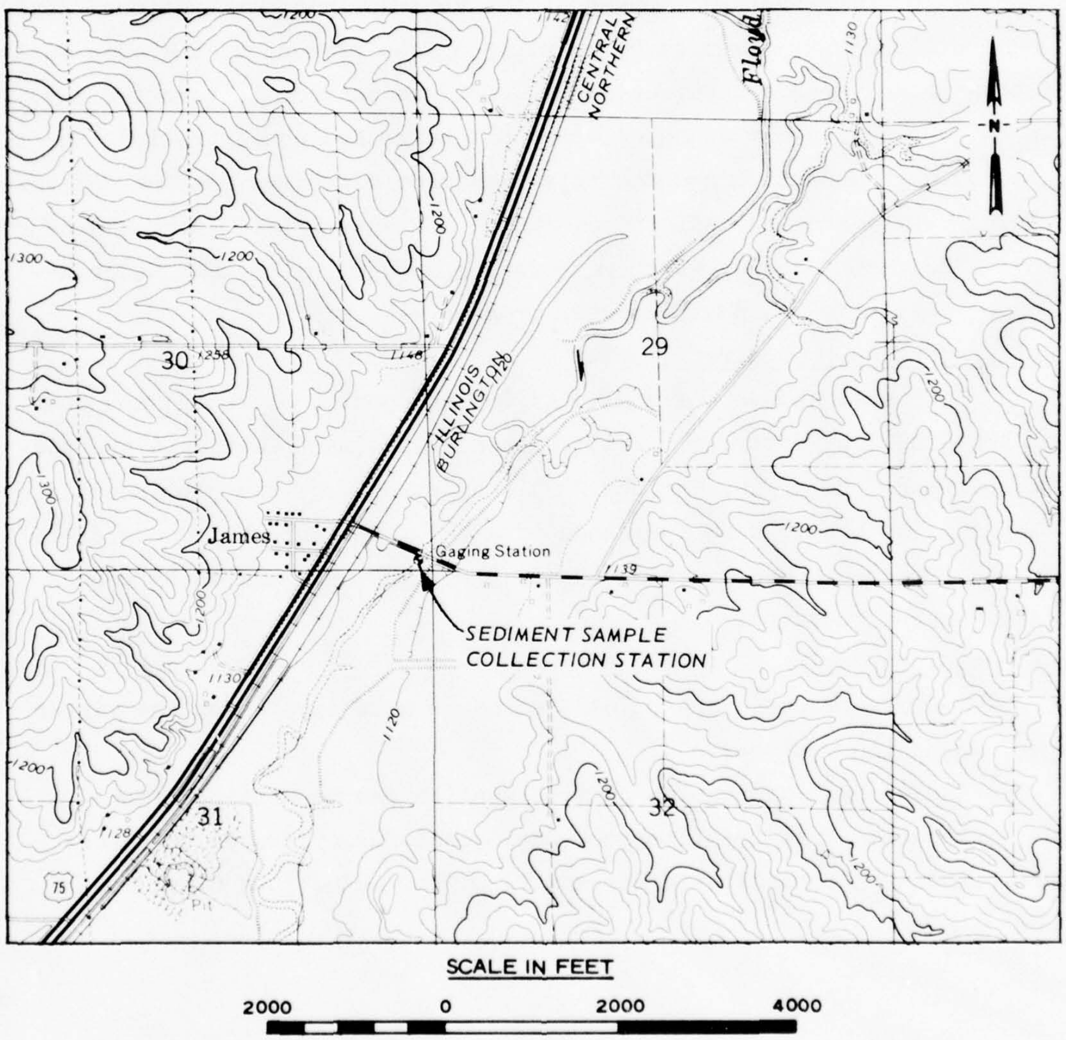

Figure A32. Site location for James, Iowa, sediment sample collection station (Source: USGS Quadrangle Map for James, Iowa, 1964)

FLOYD RIVER BASIN

06600500 FLOYD RIVER AT JAMES, IOWA

TEMPERATURE (DEG. C) OF WATER , WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973
RANDOM (INSTANTANEOUS)

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCEN-TRATION (MG/L)	OCTOBER SEDIMENT DISCHARGE (TONS/DAY)	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCEN-TRATION (MG/L)	NOVEMBER SEDIMENT DISCHARGE (TONS/DAY)	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCEN-TRATION (MG/L)	DECEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	51	68	9.4	87	90	21	90	196	48
2	47	92	12	137	771	285	90	152	37
3	45	103	13	181	789	386	75	128	26
4	45	92	11	187	780	394	65	178	31
5	45	84	10	179	479	232	61	103	17
6	47	88	11	155	376	157	58	71	11
7	47	108	14	139	282	106	56	54	8.2
8	49	120	16	130	199	70	54	44	6.4
9	50	119	16	123	256	85	52	27	3.8
10	54	121	18	123	253	84	50	32	4.3
11	51	96	13	112	225	68	48	26	3.4
12	50	91	12	117	209	66	46	37	4.6
13	50	127	17	125	209	71	44	32	3.8
14	50	108	15	90	299	73	42	13	1.5
15	51	69	9.5	110	308	91	40	11	1.2
16	54	95	14	120	244	79	40	12	1.3
17	55	130	19	127	412	141	40	24	2.6
18	47	104	13	127	361	124	40	18	1.9
19	49	111	15	120	392	127	41	12	1.3
20	56	120	18	112	712	215	42	14	1.6
21	64	76	13	95	729	187	43	11	1.3
22	65	118	21	111	260	78	44	14	1.7
23	70	89	17	106	240	69	45	14	1.7
24	71	78	15	106	163	47	46	13	1.6
25	72	135	26	101	216	59	48	16	2.1
26	72	83	16	104	198	56	50	16	2.2
27	70	79	15	103	181	50	55	13	1.9
28	67	68	12	90	106	26	60	15	2.6
29	64	109	19	75	82	17	200	1450	783
30	65	208	37	80	85	18	1500	3520	14300
31	84	168	38	--	--	--	1700	2400	11000
TOTAL	1757	--	504.9	3572	--	3482	4665	--	26314.0

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCEN-TRATION (MG/L)	JANUARY SEDIMENT DISCHARGE (TONS/DAY)	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCEN-TRATION (MG/L)	FEBRUARY SEDIMENT DISCHARGE (TONS/DAY)	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCEN-TRATION (MG/L)	MARCH SEDIMENT DISCHARGE (TONS/DAY)
1	800	1340	2890	203	54	30	1120	2250	6800
2	400	200	216	175	68	32	2650	3180	22800
3	240	174	113	214	78	45	3890	3420	35900
4	180	90	44	175	136	64	5180	2800	39200
5	160	412	178	170	208	95	4690	2210	28000
6	145	452	177	147	255	101	2640	2890	20600
7	135	170	62	134	106	38	2000	3310	17900
8	125	123	42	134	49	18	1280	2350	8120
9	115	92	29	125	42	14	888	1360	3260
10	110	116	34	115	311	97	720	1000	1940
11	105	375	106	105	342	97	780	2040	4300
12	100	420	113	100	184	50	982	2930	7770
13	100	552	149	90	278	68	811	1470	3220
14	100	641	173	80	166	36	1180	3980	12700
15	100	1080	292	80	159	34	1330	3340	12000
16	110	885	263	80	167	36	961	1800	4670
17	300	1290	1040	80	110	24	762	1000	2060
18	1000	1400	3780	80	102	22	646	770	1340
19	2400	1300	8420	85	152	35	582	635	998
20	1280	635	2190	90	150	36	525	546	774
21	828	345	771	95	276	71	485	505	661
22	411	212	235	120	313	101	449	493	598
23	280	212	160	280	580	438	432	480	560
24	264	63	45	798	1200	2590	502	806	1090
25	296	77	62	523	592	836	605	951	1550
26	255	315	217	314	269	228	678	897	1640
27	180	760	369	219	235	139	650	789	1380
28	130	130	46	258	640	446	582	688	1080
29	145	45	18	--	--	--	549	586	869
30	160	34	15	--	--	--	508	566	776
31	180	35	17	--	--	--	474	550	704
TOTAL	11134	--	22266	5069	--	5821	39531	--	245260

Figure A33. Example of sediment data for James, Iowa (Source: Water Resources for Iowa, 1973, USGS, Iowa City, Iowa) (sheet 1 of 2)

FLOYD RIVER BASIN

06600500 FLOYD RIVER AT JAMES, IOWA—CONTINUED

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCEN-TRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCEN-TRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCEN-TRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)
1	446	471	567	205	168	93	266	412	296
2	435	213	250	217	137	80	244	410	270
3	422	522	595	230	134	83	247	473	315
4	386	654	682	224	138	83	230	472	293
5	371	478	479	208	176	99	226	441	269
6	348	319	300	199	140	75	211	359	205
7	329	351	312	196	154	81	199	337	181
8	305	381	314	197	161	86	185	328	164
9	260	292	205	187	144	73	172	300	139
10	249	300	202	176	121	57	158	264	113
11	277	380	284	162	120	52	148	274	109
12	287	352	273	150	122	49	153	257	106
13	271	290	212	143	101	39	147	179	71
14	254	254	174	142	93	36	140	177	67
15	252	262	178	140	91	34	139	202	76
16	269	318	231	138	84	31	133	204	73
17	287	302	234	133	83	30	125	194	65
18	275	269	200	132	76	27	320	3190	3220
19	264	257	183	130	71	25	878	5060	11600
20	252	327	222	129	60	21	771	2170	4520
21	242	247	161	122	70	23	480	1130	1460
22	232	200	125	117	96	30	372	774	777
23	216	183	107	117	84	27	324	560	490
24	207	194	108	122	105	35	291	577	453
25	199	202	109	120	85	28	268	542	392
26	202	186	101	125	277	93	252	514	350
27	197	155	82	179	338	163	252	471	320
28	189	187	95	277	672	503	230	378	235
29	187	188.	95	308	553	460	220	330	196
30	189	183	93	334	557	502	204	283	156
31	--	--	--	305	470	387	--	--	--
TOTAL	8299	--	7173	5564	--	3405	7985	--	26981

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCEN-TRATION (MG/L)	JULY SEDIMENT DISCHARGE (TONS/DAY)	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCEN-TRATION (MG/L)	AUGUST SEDIMENT DISCHARGE (TONS/DAY)	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCEN-TRATION (MG/L)	SEPTEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	204	355	196	216	459	268	116	328	103
2	691	2280	5090	170	292	134	108	177	52
3	742	2670	5350	150	279	113	101	133	36
4	779	1990	4190	136	243	89	90	119	29
5	499	1050	1410	120	153	50	84	111	25
6	399	1290	1390	113	171	52	80	107	23
7	309	1130	943	102	128	35	79	112	24
8	277	320	239	101	200	55	81	106	23
9	1750	7730	44800	99	153	41	87	88	21
10	1580	5300	22600	94	131	33	76	92	19
11	1240	2620	8770	89	136	33	72	92	18
12	622	1150	1930	86	132	31	69	98	18
13	461	760	946	84	122	28	67	90	16
14	373	560	564	86	142	33	66	85	15
15	329	477	424	84	181	41	65	81	14
16	289	480	375	78	111	23	66	72	13
17	258	363	253	77	112	23	74	66	13
18	233	272	171	75	108	22	71	61	12
19	213	251	144	77	94	20	67	60	11
20	201	219	119	73	65	13	67	62	11
21	204	280	154	67	102	18	66	52	9.3
22	196	226	120	67	113	20	66	42	7.5
23	186	205	103	69	150	28	63	41	7.0
24	185	282	141	259	2860	4840	62	43	7.2
25	190	269	138	1040	3300	9270	64	54	9.3
26	188	271	138	527	1220	1740	82	91	20
27	167	234	106	293	488	386	80	103	22
28	154	191	79	219	238	141	82	91	20
29	147	173	69	175	213	101	140	627	237
30	209	510	346	151	178	73	148	436	174
31	268	812	588	132	172	61	--	--	--
TOTAL	13543	--	101886	5109	--	17815	2439	--	1009.3

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 108867
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 461917.2

Figure A33 (sheet 2 of 2)

Illinois River at Valley City, Illinois

Station identification

OWDC No.: 84507

Agency station No.: 05586100

Latitude/longitude: 394210/903840

Agency reporting to OWDC: USGS

River mile: 61.4 (Mile 0 at the confluence of the Illinois and Mississippi rivers; established by the CE in 1904.)

Site description

This station is on the center span of the Norfolk and Western Railway bridge, which crosses the Illinois River 0.4 mile east of Valley City, Illinois, and 1.8 mile downstream from Mauvaise Terre Creek (Figure A34).

Between the sediment collection station and the USGS gaging station at Meredosia, Illinois (mile 70.8), are a number of drainage ditches and borrow pits. Artificial levees parallel both banks for most of this reach of the river. There is a series of wing dams along both sides of the navigation channel, but mainly outside the levees. Agriculture is practiced along both banks. There are commercial docks along the left bank, and frequent barge traffic passes the sediment station. The streambed material in this reach varies from gravel to silt and clay. The channel is approximately 0.2 ft/mile. The discharges of record for the Meredosia gaging station (October 1938 to the present) are: maximum - 123,000 cfs; mean - 21,270 cfs; and minimum - 1,740 cfs. Since 17 January 1900, flow in the Illinois River has included diversion from Lake Michigan through the Chicago Sanitary and Ship Canal. Flow is influenced by many upstream structures and by backwater from Lock and Dam 26 on the Mississippi River. The sediment loads of record (June 1975 to the present) range from 3,590 to 32,700 tons/day (based on four analyzed samples).

Station chronological record

In November 1974, this station was established by the USGS to collect chemical data as part of the National Stream Quality Accounting

Network (NASQUAN). This station monitors drainage from the NASQUAN hydrologic unit 071300. The USGS began its sediment sampling program in June 1975. All sample collection, data reduction, and data publication are the responsibility of the USGS Illinois District. Samples are analyzed at the USGS Sedimentation Laboratory at Iowa City, Iowa.

Sample and data collection procedures

A single depth-integrated sample is collected monthly by USGS personnel with a US DH-59, hand-held suspended sampler, in accordance with the procedures outlined in Reference 1a. The discharges from the base gaging station at Meredosia are used for computing sediment load. There is also an auxiliary gage at Valley City (mile 61.4) used to compute flows based on gage height differences across the reach. The tabulation below presents the gaging and recording devices used at both Meredosia and Valley City during the periods of record and the agencies responsible for collecting these data:

Period	Locality	Device Used
	CE St. Louis District	
? - 1 October 1960	Valley City (mile 61.6)	Staff gage
1 October 1960 - present	Valley City (mile 61.4)	Staff gage
	U. S. Weather Bureau (now National Weather Service)	
11 October 1938 - 19 September 1962	Meredosia (mile 71.1)	Stevens A-35 continuous water-stage recorder (USGS property)
11 October 1938 - present	Meredosia (mile 70.8)	Type A wire-weight gage
11 November 1938 - present	Valley City (mile 61.4)	Type A wire-weight gage
19 September 1962 - present	Meredosia (mile 70.8)	Stevens A-35 continuous water-stage recorder (USGS property)

(Continued)

Period	Locality	Device Used
	USGS (Continued)	
11 October 1938 - 19 September 1962	Meredosia (mile 71.1)	Stevens A-35 continuous water-stage recorder
11 November 1938 - 15 April 1975	Valley City (mile 61.4)	Stevens A-35 continuous water-stage recorder
19 September 1962 - 15 April 1975	Meredosia (mile 70.8)	Stevens A-35 continuous water-stage recorder
15 April 1975 - present	Meredosia (mile 70.8) and Valley City (mile 61.4)	Fisher-Porter automatic digital recorders

Laboratory sample analysis

Suspended-sediment samples are analyzed by the USGS Sedimentation Laboratory, Iowa City, Iowa, to determine concentrations of suspended sediments as well as chemical constituents. The procedures discussed in Reference 1b are followed.

Data reduction procedures

Suspended-sediment concentration values and corresponding discharge values are entered into the USGS Water Resources Division (WRD) Water-Quality Data Files. The computer calculates suspended-sediment load (tons/day) in accordance with the procedures discussed in Reference 1c. No attempt is made to interpolate values for days when no sediment data are collected.

Data reporting procedures

Daily discharge data are published annually in Reference 20 and are also stored in the USGS WRD Water-Quality Data Files. Monthly water-quality and sediment data are published in Reference 21. Figure A35 is an example of these data. Sediment and chemical data are in both the USGS WRD Water-Quality Data Files and the Environmental Protection Agency's STORET System.

General information

Although the number of samples collected at this station since

June 1975 are not sufficient to draw any reasonable conclusions about sediment loads in this reach of the Illinois River, this station is part of the nationwide NASQUAN network and will be operated indefinitely. The NASQUAN program is committed to fulfilling the long-term objectives of detection of trends in water quality.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, P. O. Box 1026, Champaign, Illinois 61820.

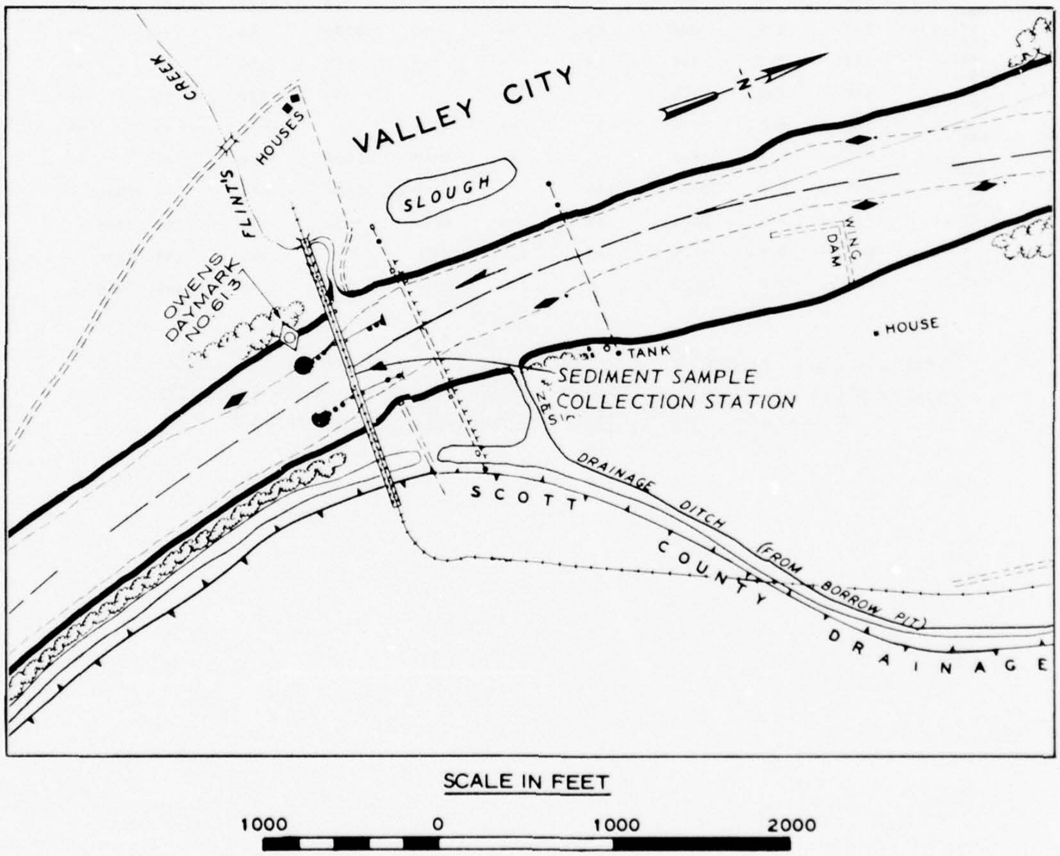

Figure A34. Site location for Valley City, Illinois, sediment sample collection station (Source: Charts Nos. 15 and 16, Charts of the Illinois Waterways, U. S. Army Engineer District, Chicago, Chicago, Illinois, 1974)

ILLINOIS RIVER BASIN

05586100 ILLINOIS RIVER AT VALLEY CITY, ILL.

WATER QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DATE	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	TUR-BID-ITY (JTU)	DIS-SOLVED OXYGEN (MG/L)	TOTAL PHYTO-PLANK-TON (CELLS PER ML)	FECAL COLI-FORM (COL. PER 100 ML)	STREP-TOCOCCI (COL-ONIES PER 100 ML)	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)
DEC.										
12...	664	7.6	3.0	60	--	--	730	1400	--	--
JAN.										
07...	647	8.9	3.0	60	--	--	8180	180	--	--
FEB.										
11...	581	7.7	3.0	10	--	--	815	140	--	--
MAR.										
12...	644	8.0	4.0	30	--	--	70	120	--	--
APR.										
15...	720	8.0	10.5	35	--	9100	--	--	--	--
MAY										
07...	600	7.9	18.0	45	--	5300	81000	550	--	--
JUNE										
10...	645	7.8	23.0	100	--	15000	81200	540	387	32700
JULY										
08...	620	7.0	28.0	66	--	6200	2100	550	308	27700
AUG.										
19...	640	7.9	27.5	65	5.5	10000	320	260	195	5000
SEP.										
17...	625	7.9	21.0	45	7.0	13000	260	190	148	3590

Figure A35. Example of water-quality and sediment data for Valley City, Illinois (Source: Water Resources Data for Illinois, 1975, USGS, Champaign, Illinois)

Illinois River at Marseilles, Illinois

Station identification

OWDC No.: 84390

Agency station No.: 05543500

Latitude/longitude: 411940/884310

Agency reporting to OWDC: USGS

River mile: 246.66 (Mile 0 is at the confluence of the Illinois and Mississippi rivers; established by the CE in 1904.)

Site description

This station is on the Illinois State Highway 170 Bridge near the town of Seneca, Illinois, 5.7 miles upstream from Marseilles Dam on the Illinois Waterway (Figure A36). The streambed material consists of gravel and large sections of broken concrete. Upstream of the bridge within 0.5 mile are several small marinas. Several minor tributaries enter the Illinois River in the vicinity of the sampling station. Agriculture is practiced extensively in this region. The streambanks are unprotected, and there are some spoil banks along this reach of the river. The estimated channel gradient is 1.0 ft/mile. Frequent barge traffic passes the sediment station. Flow past the sampling point is quite turbulent and is regulated by power plants, dams, and navigation locks upstream. Since 17 January 1900, flow in the Illinois River has included diversion from Lake Michigan through the Chicago Sanitary and Ship Canal. The discharges of record (October 1919 to the present) for the Marseilles gaging station (mile 246.6, or 0.4 mile downstream from Marseilles Dam) are: maximum - 93,900 cfs; mean - 10,760 cfs; and minimum - 1,460 cfs. The sediment loads of record (May 1975 to the present) range from 483 to 4,530 tons/day.

Station chronological record

In November 1974, this station was established by the USGS to collect chemical data as part of the National Stream Quality Accounting Network (NASQUAN). This station monitors drainage from the NASQUAN hydrologic unit 071200. The USGS began its sediment sampling program in

May 1975. All sample collection, data reduction, and data publication are the responsibility of the USGS Illinois District. Samples are analyzed at the USGS Sedimentation Laboratory at Iowa City, Iowa.

Sample and data
collection procedures

Information regarding the collection of sediment samples is identical to that presented for the Illinois River sediment sample collection station at Valley City, Illinois. The gaging station from which discharges are obtained to compute daily sediment loads is at mile 246.6. The USGS gage was originally at Morris, Illinois (mile 263.2); the Morris gage is still used by the National Weather Service as a river forecast station. The following tabulation lists gaging and recording devices used at Marseilles and Morris, as well as their periods of records and the agencies responsible for collecting these data:

Period	Location	Device Used
	U. S. Weather Bureau (now National Weather Service)	
1886 - October 1919	Morris (mile 263.2)	Staff gage
October 1919 - present	Morris (mile 263.2)	Wire-weight gage
	Illinois Power Company	
1911 - 1954	Marseilles (mile 246.6)	Staff gage?
1954 - present	Marseilles (mile 246.6)	Stevens ? continuous graphical recorder
	USGS	
October 1919 - January 1935	Morris (mile 263.2)	Wire-weight gage (Weather Bureau property)
October 1919 - January 1935	Morris (mile 263.2)	Chain gage
January 1935 - September 1939	Morris (mile 263.2)	Stevens ? continuous graphical recorder
September 1939 - 4 December 1972	Marseilles (mile 246.6)	Stevens ? continuous graphical recorder
4 December 1972 - present	Marseilles (mile 246.6)	Fisher-Porter automatic digital recorder

Laboratory sample analysis

Information is identical to that presented for the Illinois River sediment sample collection station at Valley City, Illinois.

Data reduction procedures

Information is identical to that presented for the Illinois River sediment sample collection station at Valley City, Illinois.

Data reporting procedures

Information is identical to that presented for the Illinois River sediment sample collection station at Valley City, Illinois. Figure A37 is an example of water-quality and sediment data collected for the station.

General information

Although the number of samples collected at this station since May 1975 are not sufficient to draw any reasonable conclusions about sediment loads in this reach of the Illinois River, this station is part of the nationwide NASQUAN network and will be operated indefinitely. The NASQUAN program is committed to fulfilling the long-term objectives of detection of trends in water quality.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, P. O. Box 1026, Champaign, Illinois 61820.

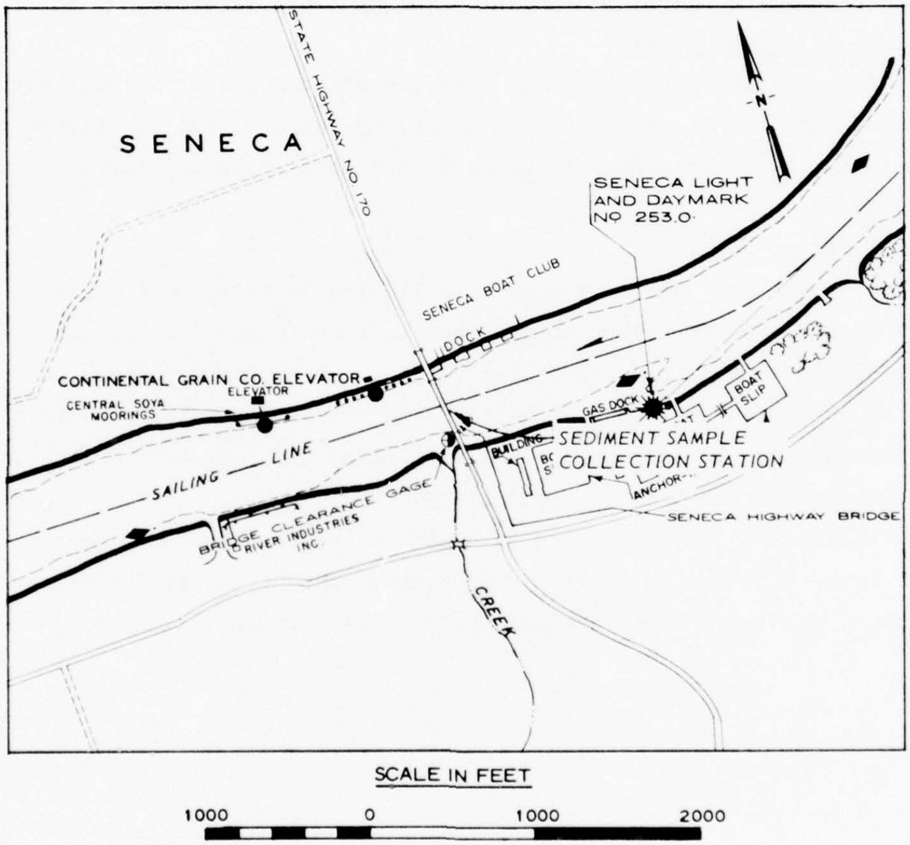

Figure A36. Site location for Marseilles, Illinois, sediment sample collection station (Source: Chart No. 56, Charts of the Illinois Waterways, U. S. Army Engineer District, Chicago, Chicago, Illinois, 1974)

ILLINOIS RIVER BASIN

05543500 ILLINOIS RIVER AT MARSEILLES, ILL.

WATER QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DATE	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	TURBIDITY (JTU)	DISSOLVED OXYGEN (MG/L)	TOTAL PHYTOPLANKTON (CELLS PER ML)	FECAL COLIFORM (COL. PER 100 ML)	STREPTOCOCCI (COLONIES PER 100 ML)	SUSPENDED SEDIMENT (MG/L)	SUSPENDED SEDIMENT DISCHARGE (T/DAY)
NOV.										
13...	792	7.3	12.0	40	--	--	450	90	--	--
DEC.										
13...	700	7.1	6.0	20	--	--	210	180	--	--
JAN.										
08...	918	7.6	6.0	20	--	--	230	11000	--	--
FEB.										
12...	885	7.9	4.0	40	--	--	280	70	--	--
MAR.										
13...	770	7.8	6.0	20	--	--	110	60	--	--
APR.										
17...	840	7.6	13.0	9	--	8900	89	84	--	--
MAY										
08...	730	--	17.0	25	--	2400	270	70	109	4530
JUNE										
11...	728	7.6	23.0	40	--	8400	90	220	101	2610
JULY										
09...	770	7.4	28.5	30	--	11000	8490	110	55	1150
AUG.										
04...	828	7.2	30.0	3	E6.4	24000	250	200	36	483
SEP.										
03...	700	7.1	25.0	21	7.3	26000	390	76	45	874

Figure A37. Example of water-quality and sediment data for Marseilles, Illinois (Source: Water Resources Data for Illinois, 1975, USGS, Champaign, Illinois)

Iowa River at Iowa City, Iowa

Station identification

OWDC No.: 52045

Agency station No.: 05454500

Latitude/longitude: 413924/0913227

Agency reporting to OWDC: USGS

River mile: 73.7 (Mile 0 is at the confluence of the Iowa and Mississippi rivers; established by the CE about 1935.)

Site description

The station is near the center of the upstream side of the Benton Street Bridge on the Iowa River in the south-central portion of Iowa City, Iowa (0.5 mile downstream from the gaging station) (Figure A38). In this reach, the river has a straight channel, and its streambed material consists of sands. It is not navigable for commercial traffic. The banks are protected with concrete-block revetment. The channel gradient is 2.2 ft/mile. Upstream from the station are: (a) urban areas including a power plant dam (0.25 mile upstream), (b) a limestone quarry at the northern edge of Iowa City, (c) wooded areas and pastureland along the bank from the northern edge of Iowa City to the Coralville Dam (9.6 miles upstream), and (d) agricultural areas in the watersheds of two contributing streams (Clear Creek and Rapid Creek) that flow into the Iowa River between the Coralville Dam and the sediment collection station. Flows since 17 September 1958 have been regulated by the Coralville Dam (mile 83.3). Ice may affect flows during the winter months. Diurnal fluctuations at low stages are caused by the power plant (0.25 mile upstream) and by diversions of both the Iowa City and the State University of Iowa water plants. Highest discharge before the period of record estimated from flood marks and information provided by local residents was 70,000 cfs in 1851.

The maximum, mean, and minimum daily discharges occurring from the beginning of the period of record (1 June 1903) through water year 1958 were 42,500 cfs, 1,600 cfs, and 29 cfs, respectively. From water year

1959 to the present, the maximum, mean, and minimum daily discharges have been 15,000 cfs, 2,521 cfs, and 81 cfs, respectively. Maximum, mean, and minimum daily sediment loads occurring from the beginning of the period of record (October 1943) through water year 1958 were 177,000, 2,840, and 2 tons/day, respectively. From water year 1959 to the present, the maximum, mean, and minimum daily sediment loads have been 159,000, 1,158, and 0.9 tons/day, respectively.

Station chronological record

This station was established in October 1943 by the USGS at the recommendation of the CE; its operation is funded by the Iowa Geological Survey (state agency). Samples are collected and analyzed by the USGS Iowa District, which is responsible for data reduction and publication. In former years, the St. Anthony Falls Hydraulics Laboratory did test work here. The State University of Iowa uses this station for both training and experimental purposes. River stage data have been collected 0.5 mile upstream since 1903.

Sample and data collection procedures

A single sample is collected by USGS personnel Monday through Friday of each week throughout the year. During periods of high flow, the sampling interval and the number of samples taken increase. A US D-43, depth-integrated sampler is used, except during winter months when a US DH-59, hand-held sampler may be used. Periodically, equal-transit-rate (ETR) samples are also taken. The sediment load calculated by the ETR method is used to derive a correction factor to be used in estimating the load with the single depth-integrated vertical. No daily bed-load samples are taken; however, bed-material samples are taken on the average of four times yearly with a US BM-54 sampler. The use of these samplers and the ETR method are explained in Reference 1a.

Water temperatures have been collected with sediment samples since 1944.

Gaging in the vicinity at Iowa City began on 1 June 1903 and has continued to the present with only brief interruptions. The station is operated as a cooperative effort of the USGS Iowa District, the Iowa

Institute of Hydraulic Research, and the Iowa Geological Survey (state agency). The following tabulation presents the gaging and recording devices used in the vicinity of Iowa City during the period of record:

Period	Locality	Device Used
1 June 1903 - 21 July 1906	Iowa Avenue Bridge (mile 74.4)	Chain gage
29 November 1907 - 29 October 1913	Power plant, 200 ft upstream from present position (mile 74.2)	Staff gage
30 October 1913 - 18 November 1921	Benton Street Bridge (present sediment station) (mile 73.7)	Chain gage
19 November 1921 - present	Right bank, 25 ft downstream from State University of Iowa hydraulics laboratory (mile 74.2)	Stevens remote-registering water-stage recorder driven by float*
? - present	Right bank, 25 ft downstream from State University of Iowa hydraulics laboratory (mile 74.2)	Enameled staff gage
? - present	Memorial Union Footbridge (mile 74.2)	Enameled staff gage
11 October 1969 - present	Right bank, 25 ft downstream from State University of Iowa hydraulics laboratory (mile 74.2)	Fisher-Porter automatic digital recorder (driven by float)

* Recorder itself physically located on fourth floor of hydraulics laboratory.

Laboratory sample analysis

Information identical to that presented for the Cedar River sediment sample collection station at Cedar Rapids, Iowa, except for the following: (a) laboratory determinations are made for specific conductance; (b) chemical analyses from samples taken at this station were made from 1906 to 1907 and from 1944 to 1954, and CE Rock Island

District also has chemical analysis run on samples taken from Coralville Lake (9.6 miles upstream).

Data reduction procedures

Information is identical to that presented for the Boyer River sediment sample collection station at Logan, Iowa.

Data reporting procedures

All data prior to 1961 for suspended-sediment concentration and particle size, and bed-material particle size, as well as temperature, were published annually in Reference 16. Since 1961, the data have been published in Reference 14. Discharge data prior to 1961 were published in Reference 12 and since that date in Reference 14. These data are also entered in WATSTORE, an automated information retrieval system operated by the USGS. An example of mean discharge, mean concentration, and suspended-sediment discharge data is presented in Figure A39.

General Information

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

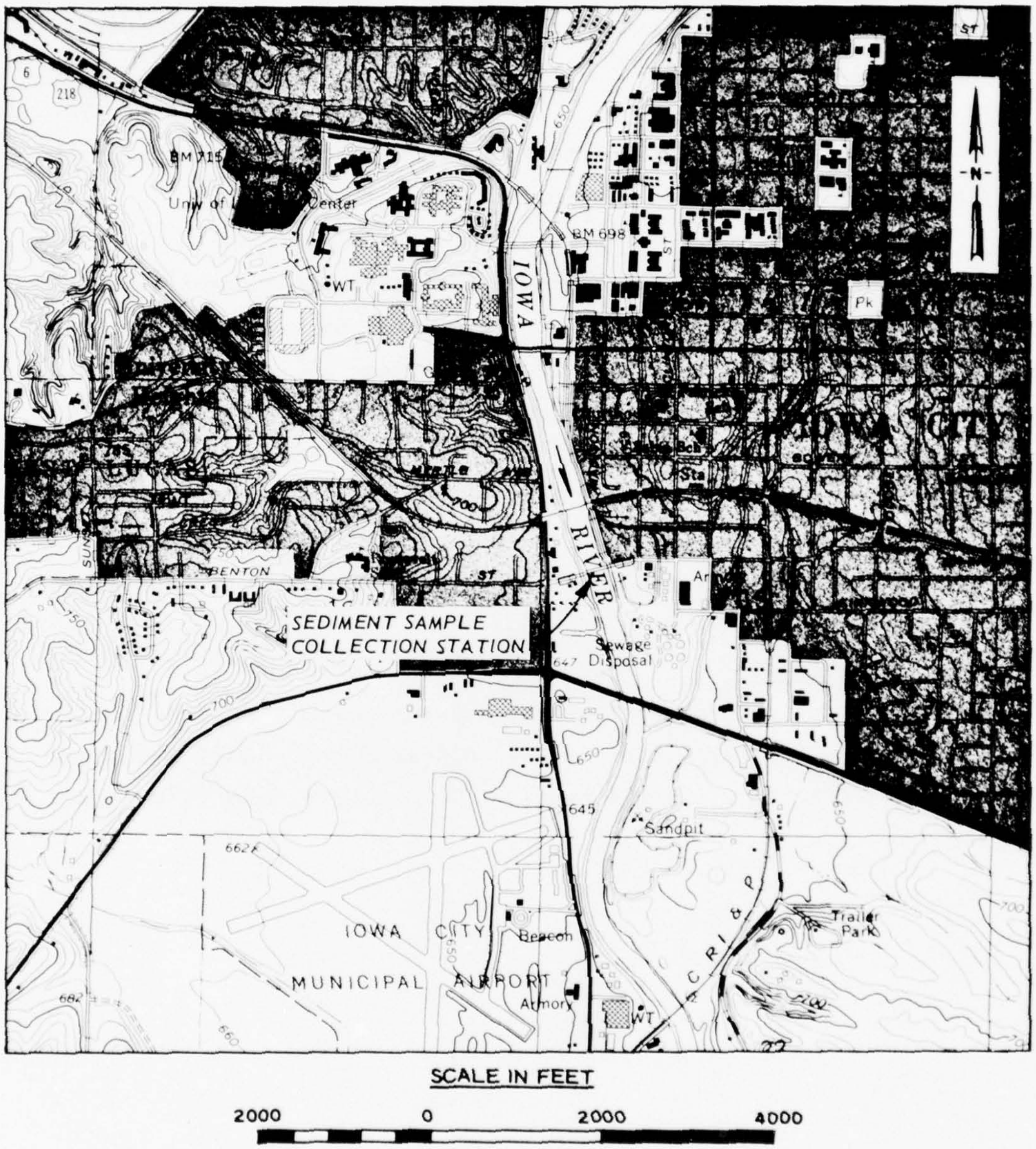

Figure A38. Site location for Iowa City, Iowa, sediment sample collection station (Source: USGS Quadrangle Map for Iowa City, West, Iowa, 1965)

IOWA RIVER BASIN

05454500 IOWA RIVER AT IOWA CITY, IOWA

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCENTRATION (MG/L)	OCTOBER SEDIMENT DISCHARGE (TONS/DAY)	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCENTRATION (MG/L)	NOVEMBER SEDIMENT DISCHARGE (TONS/DAY)	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCENTRATION (MG/L)	DECEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	3500	139	1310	1170	60	190	2480	20	134
2	3080	77	640	1080	85	248	2090	22	124
3	2800	60	454	1080	99	289	1680	28	127
4	2720	93	683	1080	86	251	1830	30	148
5	2320	74	464	1080	62	181	2340	34	215
6	2320	51	319	1060	71	207	2730	46	339
7	2060	45	253	1060	71	207	2850	33	254
8	1790	42	203	1080	70	204	2490	22	148
9	1530	41	169	1040	58	163	2470	20	133
10	1260	49	167	952	42	108	2420	23	150
11	1500	65	263	952	35	90	2410	28	182
12	1980	87	465	952	35	90	2420	30	196
13	3120	114	960	942	49	125	2390	21	136
14	3820	147	1520	946	53	135	2370	17	109
15	4000	222	2400	946	51	130	2350	16	102
16	3980	264	2840	946	49	125	2320	14	88
17	3920	119	1260	940	48	122	1700	12	55
18	3500	62	586	940	46	117	1090	16	47
19	2510	52	352	934	42	106	1080	23	67
20	1900	51	262	970	37	97	1070	18	52
21	1740	49	230	1170	40	126	1100	18	53
22	1740	47	221	1310	72	255	1180	23	73
23	1740	44	207	1370	86	318	1270	28	96
24	1740	48	226	1670	79	356	1280	33	114
25	1740	45	211	1880	57	289	1420	44	169
26	1670	49	221	1980	32	171	1840	61	303
27	1530	52	215	2220	33	198	2300	41	255
28	1520	52	213	2380	30	193	2590	18	126
29	1470	104	413	2490	33	222	2720	20	147
30	1390	115	432	2490	26	175	2710	24	176
31	1280	77	266	--	--	--	2880	29	226
TOTAL	71190	--	18425	39150	--	5488	63870	--	4544

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCENTRATION (MG/L)	JANUARY SEDIMENT DISCHARGE (TONS/DAY)	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCENTRATION (MG/L)	FEBRUARY SEDIMENT DISCHARGE (TONS/DAY)	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCENTRATION (MG/L)	MARCH SEDIMENT DISCHARGE (TONS/DAY
1	2930	33	261	5840	90	1420	3640	117	1150
2	2540	30	206	6320	101	1720	3790	125	1280
3	1640	16	71	6190	121	2020	4130	141	1570
4	1160	16	50	6100	121	1990	5380	263	3820
5	914	16	39	5850	110	1740	6380	241	4150
6	896	15	36	5080	83	1140	6100	183	3010
7	900	15	36	3740	57	576	6200	224	3750
8	900	12	29	2900	44	345	6350	188	3220
9	900	13	32	1760	40	190	6450	183	3190
10	900	22	53	1000	36	97	6320	184	3140
11	900	11	27	1320	31	110	6330	167	2850
12	900	29	70	1870	29	146	6470	68	1190
13	900	25	61	2240	142	859	6410	75	1300
14	900	15	36	2010	139	754	6120	72	1190
15	900	8	19	2200	121	719	5050	67	914
16	900	7	17	2190	101	597	4260	76	874
17	911	5	12	2320	85	532	4630	100	1250
18	948	49	125	2640	114	813	4490	53	643
19	1070	86	248	2550	84	578	3790	55	563
20	1750	103	487	2510	55	373	2960	53	424
21	2610	199	1400	2700	76	554	2950	54	430
22	3000	68	551	3430	363	3360	2960	43	344
23	3360	39	354	3490	189	1780	2650	39	279
24	3530	39	372	3400	133	1220	2300	37	230
25	3530	23	219	3330	239	2150	2230	60	361
26	3670	49	486	3060	144	1190	2230	61	367
27	4850	224	2930	3030	253	2070	2100	60	340
28	4260	111	1280	3430	258	2390	1830	65	321
29	3980	55	591	--	--	--	1930	76	396
30	4470	229	2760	--	--	--	2990	256	2070
31	5970	231	3720	--	--	--	3520	170	1620
TOTAL	66989	--	16578	92500	--	31433	132940		46236

Figure A39. Example of sediment and discharge data for Iowa City, Iowa (Source: Water Resources Data for Iowa, 1974, USGS, Iowa City, Iowa) (sheet 1 of 2)

IOWA RIVER BASIN

05454500 IOWA RIVER AT IOWA CITY, IOWA--CONTINUED

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	3390	87	796	1440	105	408	10200	167	4600
2	2960	87	695	2320	171	1070	10200	185	5090
3	2640	138	984	4140	253	2830	10200	192	5290
4	3120	312	2630	4320	176	2050	10100	149	4060
5	3950	169	1800	4260	137	1580	10000	126	3400
6	4080	147	1620	4250	118	1350	9980	101	2720
7	4050	137	1500	4540	128	1570	10900	273	8030
8	4010	122	1320	4570	149	1840	10500	250	7090
9	3960	87	930	4380	142	1680	11200	248	7500
10	3910	94	992	4260	81	932	10400	145	4070
11	3860	128	1330	4230	57	651	10000	97	2620
12	3170	105	899	4040	51	556	9930	85	2280
13	2820	90	685	4390	1050	12400	9890	115	3070
14	4560	342	4210	5050	2960	40400	9900	84	2250
15	5050	196	2670	2090	850	4800	9930	70	1880
16	4800	148	1920	4720	4680	79300	9930	69	1850
17	4330	138	1610	7610	7540	159000	9920	87	2330
18	3540	109	1040	5090	5570	76500	9890	152	4060
19	2830	87	665	2770	1870	14000	10100	96	2670
20	2860	78	602	1730	280	1310	9920	65	1740
21	3170	184	1570	1960	277	1470	10000	92	2480
22	3260	164	1450	3690	364	3630	11100	246	7370
23	3280	130	1150	4360	385	4550	10800	209	6090
24	3390	116	1060	4540	374	4580	9950	93	2500
25	3360	93	844	4540	358	4390	9820	81	2150
26	3450	116	1080	4630	354	4430	9830	75	1990
27	3320	114	1020	4640	344	4310	9920	78	2090
28	3310	500	4470	5480	860	12700	9900	80	2140
29	4570	1610	22500	9060	2750	67300	9910	80	2140
30	1980	250	1340	10400	770	21600	9890	70	1870
31	--	--	--	10400	180	5050	--	--	--
TOTAL	107000	--	65382	143920	--	538237	304210	--	107420

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	9860	64	1700	2240	84	508	4410	101	1200
2	9790	55	1450	2230	91	548	4370	97	1140
3	9800	81	2140	2420	112	732	3830	95	982
4	9920	97	2600	2750	117	869	3210	81	702
5	9780	107	2830	2720	86	632	3170	73	625
6	9660	113	2950	2470	90	600	2700	67	488
7	9420	113	2870	1970	87	463	2140	70	404
8	8790	89	2110	1640	87	385	2110	73	416
9	7940	72	1540	1550	422	1770	2080	70	393
10	7920	61	1300	2040	700	3860	2070	67	374
11	8130	62	1360	1420	365	1400	1870	68	343
12	7590	60	1230	2810	955	7250	1290	69	240
13	6860	59	1090	3650	1120	11000	857	115	266
14	6280	50	848	4050	802	8770	777	126	264
15	6210	49	822	4540	468	5740	764	90	186
16	6140	57	945	5120	742	10300	794	64	137
17	6080	66	1080	5150	690	9590	756	55	112
18	6020	75	1220	4790	335	4330	841	52	118
19	5940	81	1300	4730	287	3670	930	61	153
20	5880	79	1250	4830	252	3290	925	59	147
21	5570	460	6920	4760	197	2530	917	55	136
22	5630	1200	18200	5080	256	3510	914	54	133
23	5050	165	2250	4680	152	1920	911	50	123
24	4950	92	1230	4610	117	1460	912	54	133
25	4860	87	1140	4560	112	1380	909	54	133
26	4170	84	946	4520	110	1340	793	52	111
27	3050	81	667	4470	102	1230	659	40	71
28	2310	77	480	4520	103	1260	669	35	63
29	2270	77	472	4580	105	1300	664	32	57
30	2240	94	569	4530	105	1280	656	30	53
31	2220	85	509	4470	102	1230	--	--	--
TOTAL	200330	--	66018	113900	--	94147	47898	--	9703

TOTAL DISCHARGE FOR YEAR (CFS-DAYS)	1383897
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS)	1003611

Figure A39 (sheet 2 of 2)

Kansas River at Bonner Springs-Desoto, Kansas

Station identification

OWDC No.: 54653

Agency station No.: 156

Latitude/longitude: Bonner Springs 390337/945221
DeSoto 385900/945752

Agency reporting to OWDC: CE

River mile: Bonner Springs, 19.8; DeSoto, 31.0 (Mile 0 is at the confluence of the Kansas and Missouri rivers; established by the CE in 1969.)

Site description

The station at Bonner Springs was established in 1948. The site was considered to be at a sufficient distance from the mouth of the Kansas River such that backwater from the Missouri River would not affect the suspended-sediment measurements. The station was moved to DeSoto on 1 October 1973 because commercial sand dredging operations downstream from the station had begun to significantly change the regime of the river. Data from the two stations are considered by the CE to be from the same site.

The station at Bonner Springs was on the Kansas Highway 7 Bridge (Figure A40), which crosses a bend of the Kansas River 0.6 mile east of Bonner Springs and 0.9 mile downstream from Wolf Creek. The banks are natural in this reach with no bank protection except scattered willows and some riprap at the bridge heads. The gradient of the streambed through this reach is 1.4 ft/mile, and the bed material consists of sand. The river is not navigable for commercial traffic. There is a bluff on the left bank (some industrial activity on the bluff), and on the right bank the floodplain of the Kansas River (used for agriculture) extends approximately 1 mile to the base of a continuous line of hills.

The station at DeSoto is on a county-maintained bridge that crosses the Kansas River at the northern edge of the town (Figure A41). The banks are natural except for protection at the bridgehead and a few

automobile bodies and sections of sheet metal placed by a landowner on the left bank upstream from the bridge to protect his barn and house. The gradient of the streambed through this reach is 0.8 ft/mile, and the bed material consists of sand. There is a bluff on the right bank, and on the left bank the floodplain of the Kansas River (used for agriculture) extends approximately 1 mile to the base of a continuous line of hills.

The natural streamflow and sediment loads are greatly affected by numerous upstream diversions (for irrigation) and control structures, the majority of which became operational between 1962 and 1969. Between 1917 and 1962, the discharges of record were: maximum - 510,000 cfs; mean - 6,574 cfs; and minimum - 160 cfs. From 1969 to the present, the discharges of record are: maximum - 247,000 cfs; mean - 7,622 cfs; and minimum - 700 cfs. From 1948 to 1962, the sediment loads of record are: maximum - 6,430,000 tons/day; mean - 97,300 tons/day; and minimum - 16 tons/day. From 1969 to the present, the sediment loads of record are: maximum - 1,131,144 tons/day; mean - 42,100 tons/day; and minimum - 26 tons/day.

Station chronological record

This station was established in 1948 to monitor the sediment contribution of the Kansas River to the Missouri River. Prior to 1 October 1973, the CE Kansas City District (KCD) was responsible for collecting the samples, as well as for reducing and publishing the resulting data. The samples are now collected by the USGS Kansas District. The samples were analyzed by the KCD Laboratory until May 1973. The CE Missouri River Division Laboratory in Omaha analyzed the samples from May 1973 to September 1973. The samples are now analyzed by the laboratory of the USGS Kansas District.

Sample and data collection procedures

Samples were collected at Bonner Springs by a paid observer. A single depth-integrated vertical was taken twice weekly during normal flows using a US D-43 sampler. Samples were taken twice daily during high flows. The stream-gaging station was originally on the Highway 7

Bridge. Stage was measured with a staff gage from 9 July 1917 through 23 April 1934. The gage was 0.5 mile upstream from 24 April 1934 to 25 November 1961, and a Stevens A-35 recorder was used. The gage was back on the bridge from 26 November 1961 to 30 September 1973, when the station was moved to DeSoto. During this latter period, a Type A wire-weight gage and a Stevens digital water-stage recorder were used.

After the station was moved to DeSoto, a paid observer has continued to take samples as described above; however, a US D-49 sampler attached to the center span of the bridge on the upstream side is now used. Personnel of the USGS Kansas District collect point-integrated samples bimonthly to determine if a correction factor should be applied to the single vertical taken by the paid observer. The point-integrated samples are taken with a US P-61 sampler on three verticals. Five points are taken on each vertical when the depth is sufficient. Each vertical passes through the centroid of a cross-sectional area determined by the equal-discharge-rate method (Reference 1a). Once a year, 40 verticals are taken by the USGS to verify the validity of the sediment loads estimated from the three verticals.

In addition, bed samples are taken regularly with a US B-54 sampler. Stage is measured with a Fisher-Porter automatic digitial recorder, Model 1542, and a Stevens graphical recorder, Model A-35, both driven by a bubble gage (manometer). Instantaneous stage can be obtained via telephone using the Telemark attachment connected to the Fisher-Porter recorder. A wire-weight gage is also available as needed. This gage is attached to the downstream side of the bridge, approximately one third of the distance across the bridge from the left bank.

Laboratory sample analysis

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Suspended-sediment data are reported by the KCD in Reference 11.

Discharge data were reported in Reference 12 prior to 1961, and since 1961, they have been reported in Reference 10. Examples of these data are shown in Figures A42 and A43, respectively.

General information

Records for this station are considered to be good, except those for January, which are poor.

Additional information on this station can be obtained from: U. S. Army Engineer District, Kansas City, Hydrologic Engineering Branch, Water Control Section, 700 Federal Office Building, 601 East 12th St., Kansas City, Missouri 64106.

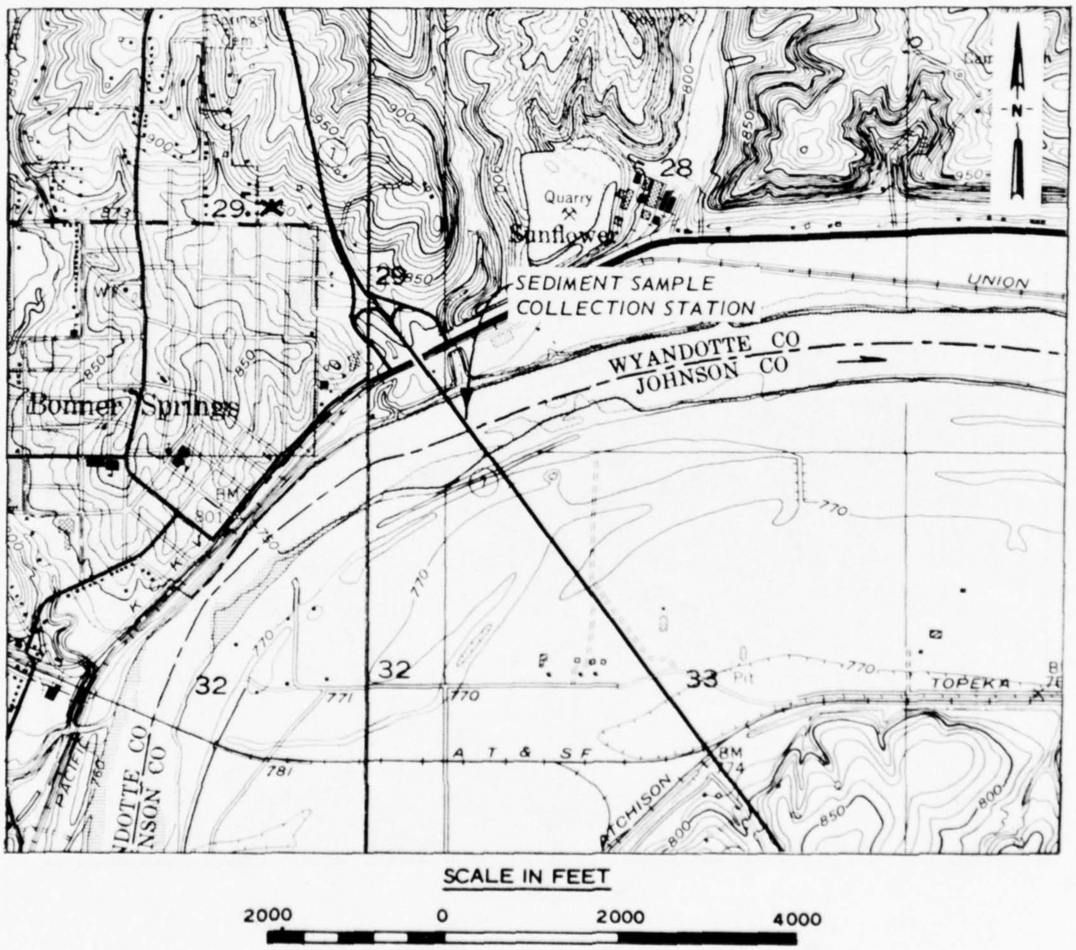

Figure A40. Site location for Bonner Springs, Kansas, sediment sample collection station (Source: USGS Quadrangle. Bonner Springs, Kansas, 1970)

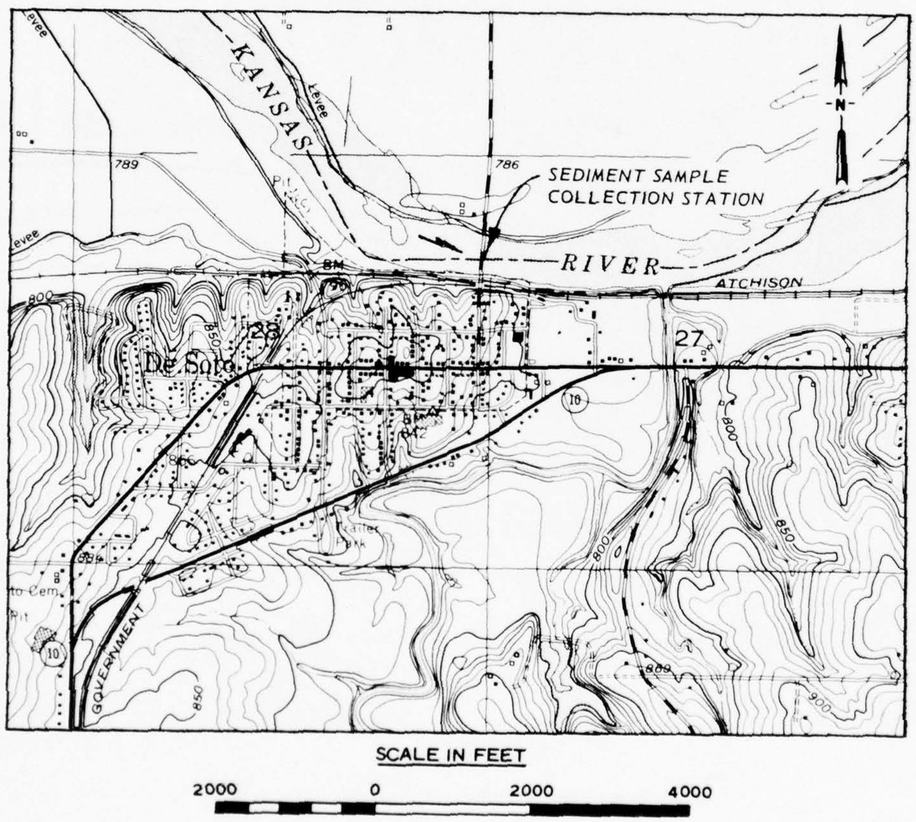

Figure A41. Site location for DeSoto, Kansas, sediment sample collection station (Source: USGS Quadrangle, DeSoto, Kansas, 1970)

KANSAS RIVER AT BONNER SPRINGS, KANSAS

SUSPENDED SEDIMENT LOAD - TONS | WATER YEAR OCT 1968 - SEP 1969

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1,362	5,481	1,136	28,040	6,723	128,700	49,910	167,800	103,900	82,760	6,169	1,110
2	1,337	4,347	1,179	15,700	6,928	250,400	16,040	92,650	59,510	41,100	4,877	1,154
3	2,024	3,564	1,132	8,685	6,602	305,800	18,450	38,680	27,170	31,300	5,609	1,574
4	3,131	2,971	1,315	5,751	6,602	272,000	14,470	22,320	15,610	19,480	7,088	2,858
5	4,555	2,632	2,313	7,695	6,602	264,200	236,900	68,560	37,180	13,920	4,991	5,669
6	4,823	2,424	2,942	7,020	19,930	198,600	206,900	63,680	19,360	11,580	2,690	16,390
7	4,928	2,731	2,324	4,160	74,410	319,500	85,810	23,340	5,708	9,666	1,688	13,220
8	5,203	3,364	1,210	4,296	33,900	207,200	151,600	38,350	5,637	40,880	1,064	8,344
9	9,032	3,255	557	4,068	14,340	88,060	213,600	154,700	17,540	133,900	1,083	12,950
10	16,480	2,179	299	3,318	8,073	83,130	57,590	188,900	10,740	204,700	1,218	24,570
11	6,981	2,288	221	2,759	5,735	55,690	19,730	88,740	3,654	151,000	1,274	22,280
12	2,415	2,373	224	2,181	5,453	32,810	7,698	34,780	8,868	72,950	1,278	15,010
13	1,380	2,495	219	1,883	5,794	19,580	4,051	18,040	49,250	36,510	1,400	10,280
14	1,755	2,818	293	1,585	7,233	14,140	3,249	12,700	194,100	38,580	1,205	7,711
15	1,403	9,914	240	1,320	10,350	12,110	18,430	12,310	143,400	28,350	1,409	5,967
16	1,233	6,545	102	4,795	14,480	10,490	53,060	11,290	43,380	15,720	1,885	4,847
17	11,890	3,893	108	162,100	19,770	8,616	139,400	11,360	18,430	10,190	1,548	4,172
18	374,300	2,320	205	259,000	24,210	8,199	290,300	30,410	58,440	7,154	1,368	3,328
19	158,800	1,715	2,943	191,000	12,820	8,726	135,800	26,240	72,410	6,005	1,300	2,472
20	63,900	1,172	51,150	125,100	5,808	8,467	48,940	18,480	41,850	26,490	1,176	1,879
21	48,830	1,874	37,460	58,210	5,249	5,346	19,090	24,960	79,530	62,210	1,032	1,478
22	46,690	3,577	11,640	6,748	7,063	3,221	15,810	63,860	270,300	22,320	940	1,085
23	33,630	3,360	4,640	1,960	12,580	2,421	13,220	160,200	341,200	24,430	904	891
24	34,140	2,741	1,836	4,698	26,080	22,680	12,300	123,600	275,600	38,960	841	716
25	28,920	2,208	1,032	9,056	35,720	169,000	32,580	159,100	219,600	88,980	751	622
26	24,820	1,798	1,056	7,187	26,910	205,700	157,500	155,000	241,300	273,100	503	571
27	25,030	1,792	1,922	5,462	41,000	195,000	841,900	131,100	571,300	113,900	557	475
28	22,030	1,631	3,439	7,484	91,450	159,000	788,700	111,300	342,700	35,240	737	460
29	16,740	1,562	3,773	10,670		108,000	396,700	79,720	144,800	17,420	864	389
30	10,330	1,106	6,436	13,620		51,140	181,500	52,790	74,170	12,520	1,006	401
31	7,218		19,430	10,760		53,680		52,570		10,110	1,036	
	975,310		162,776		541,813		4,231,228		3,496,637		59,491	
		90,130		976,311		3,271,606		2,237,530		1,681,425		172,873

YEARLY TOTAL - 17,897,130 TONS

Figure A42. Example of sediment data for Bonner Springs, Kansas (Source: Suspended Sediment in the Missouri River, 1965-1969, U. S. Army Engineer District, Omaha, Omaha, Nebraska, 1972)

KANSAS RIVER BASIN

6-8925. Kansas River at Bonner Springs, Kans.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4,020	5,970	5,260	4,600	4,800	14,100	23,700	26,800	16,300	15,900	9,520	2,740
2	3,960	5,750	5,460	4,600	4,800	26,500	18,000	25,800	15,200	13,600	8,210	2,850
3	4,520	5,500	5,240	4,500	5,000	31,200	13,400	19,100	12,900	14,300	8,310	3,430
4	4,580	5,240	5,410	4,500	6,000	31,000	12,000	14,500	11,800	11,800	8,750	3,780
5	4,690	5,130	6,590	4,500	9,000	35,200	19,500	18,400	13,500	10,300	7,110	4,980
6	4,690	5,280	6,810	4,500	11,000	34,700	19,900	17,600	9,580	10,100	5,860	9,370
7	4,810	5,620	6,620	4,500	15,000	32,500	14,000	12,900	6,820	9,550	5,210	9,600
8	4,830	6,230	4,980	4,000	14,600	27,700	14,700	13,400	9,490	12,000	4,380	8,830
9	6,850	5,740	3,440	4,000	11,800	21,600	17,700	23,100	11,200	15,900	4,010	9,590
10	11,700	5,380	2,740	4,000	11,000	17,200	15,800	26,700	10,200	22,300	3,760	9,380
11	7,990	5,650	2,730	4,000	11,800	16,500	12,600	24,900	7,960	21,100	3,630	8,970
12	4,970	5,860	2,770	4,000	9,180	15,000	7,920	18,400	9,660	15,800	3,640	7,390
13	4,260	6,160	2,700	3,800	7,400	12,500	5,770	13,100	15,200	13,800	4,320	5,900
14	5,000	6,140	2,710	3,600	7,050	11,900	5,470	11,200	25,400	15,200	3,720	5,560
15	4,330	9,180	2,220	3,600	6,500	11,500	10,500	11,400	19,100	14,000	4,350	5,350
16	4,150	8,080	1,880	3,600	5,960	11,100	13,100	10,200	10,500	10,400	5,370	5,230
17	11,900	7,210	2,020	3,600	5,720	9,670	19,700	9,560	7,420	8,580	4,410	5,100
18	45,300	6,610	2,530	3,600	5,470	9,490	30,200	12,800	11,100	7,570	3,620	4,710
19	28,000	6,350	4,360	3,600	5,050	10,100	20,700	12,000	14,900	6,950	3,210	3,940
20	16,100	6,200	12,800	3,800	4,780	11,200	14,500	9,780	12,400	10,900	3,110	3,440
21	13,200	7,080	11,100	4,000	6,480	8,250	10,400	9,940	13,700	12,800	2,940	3,180
22	13,100	7,360	6,630	4,000	6,380	5,680	9,600	14,600	24,600	8,700	2,900	2,820
23	9,730	7,320	4,910	3,600	7,280	4,720	8,440	25,800	35,500	11,000	2,790	2,740
24	10,900	7,250	3,400	3,600	10,500	12,000	7,990	21,800	34,600	13,000	2,830	2,630
25	10,500	6,290	2,940	4,000	10,500	27,700	12,700	33,100	31,900	19,500	2,780	2,530
26	10,100	5,550	3,260	4,400	9,060	29,300	23,900	35,000	26,600	23,200	2,660	2,320
27	10,300	5,530	4,450	4,800	9,860	33,900	62,900	32,800	52,500	14,800	2,580	2,170
28	10,200	5,490	5,790	4,800	11,600	35,900	81,800	31,700	38,000	14,500	2,480	2,120
29	9,540	5,260	5,200	4,800	------	33,900	44,400	25,900	26,500	12,900	2,460	2,030
30	7,500	5,120	4,800	4,800	------	32,100	27,000	18,800	14,100	12,200	2,660	2,100
31	6,520	------	4,600	4,800	------	28,400	------	17,700	------	11,700	2,740	------
TOTAL	298,240	185,530	146,350	128,500	233,570	642,510	598,290	598,780	548,630	414,350	134,320	144,780
MEAN	9,621	6,184	4,721	4,145	8,342	20,730	19,940	19,320	18,290	13,370	4,333	4,826
MAX	45,300	9,180	12,800	4,800	15,000	35,900	81,800	35,000	52,500	23,200	9,520	9,600
MIN	3,960	5,120	1,880	3,600	4,780	4,720	5,470	9,560	6,820	6,950	2,460	2,030
AC-FT	591,600	368,000	290,300	254,900	463,300	1,274M	1,187M	1,188M	1,088M	821,900	266,400	287,200

CAL YR 1968 TOTAL 2,264,290 MEAN 6,187 MAX 61,300 MIN 1,020 AC-FT 4,491,000
WTR YR 1969 TOTAL 4,073,850 MEAN 11,160 MAX 81,800 MIN 1,880 AC-FT 8,080,000

Figure A43. Example of discharge data for Bonner Springs, Kansas (Source: Water Resources for Kansas, 1960, USGS, Lawrence, Kansas)

Kansas River at Lecompton, Kansas

Station identification

OWDC No.: 50259

Agency station No.: 06891000

Latitude/longitude: 390307/952315

Agency reporting to OWDC: CE

River mile: 63.8 (Mile 0 is at the confluence of the Kansas and Missouri rivers; established by the CE in 1969.)

Site description

The sediment sample collection station and the stream gaging station are on a county-maintained highway bridge at Lecompton, Kansas, 0.8 mile downstream from the confluence of the Delaware and Kansas rivers (Figure A44). There is no bank protection in the vicinity of the stations, and there are no artificial levees. On the left bank of the river is a floodplain extending approximately 2 miles to a line of hills. The right bank of the river is a bluff on which the town of Lecompton is located. The land in this region is used primarily for agriculture. The streambed material consists of fine sand, and the gradient through this reach is 1.5 ft/mile. The stream is braided at low flow and is not navigable for commercial traffic.

The natural streamflow and sediment loads are greatly affected by numerous upstream diversions (for irrigation) and control structures, the majority of which became operational between 1962 and 1969. Prior to 1962, the discharges of record (from 1936) were: maximum - 483,000 cfs; mean - 6,849 cfs; and minimum - 185 cfs. After 1969, the discharges of record (to the present) are: maximum - 129,000 cfs; mean - 8,261 cfs; and minimum - 600 cfs. The sediment loads of record (May 1974 to the present) are: maximum - 571,497 tons/day; mean - 23,300 tons/day; and minimum - 360 tons/day.

Station chronological record

The sediment sample collection station was established by the CE in May 1974 to monitor the sediment load in this reach of the Kansas

River and is currently in operation. During the period of record, sample collection and the reduction and publication of data have been the responsibility of the CE Kansas City District (KCD). The analysis of samples is the responsibility of the USGS Kansas District.

Sample and data collection procedures

Samples are collected by CE-paid observers using a US D-49, depth-integrated sampler. Samples are collected on one vertical varying from twice a week to twice daily depending on the flow. The USGS also obtains samples once a month to determine if a correction factor should be applied to the data derived from the samples taken by the paid observers. Two or three depth-integrated verticals are taken with a US P-61 sampler. The spacing between verticals is determined by the equal-discharge-rate method (Reference 1a). Bed samples are also collected once a month by the USGS with a US BM-54 sampler. River stage was measured prior to 30 July 1952 with a wire-weight gage. A Stevens graphical recorder was used from 31 July 1952 to 16 April 1964; since that date, a Fisher-Porter automatic digital recorder, Model 1542, has been used.

Laboratory sample analysis

The information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

Th information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Since the station was established in May 1974, no suspended-sediment data have been published. Discharge has been published on a daily basis from 1936 to 1961 in Reference 12 and since 1961 in Reference 10.

General information

Sediment and discharge records for this station are considered to be good.

Additional information on this station can be obtained from: U. S. Army Engineer District, Kansas City, Hydrologic Engineering Branch, Water

Control Section, 700 Federal Building, 601 East 12th St., Kansas City, Missouri 64106.

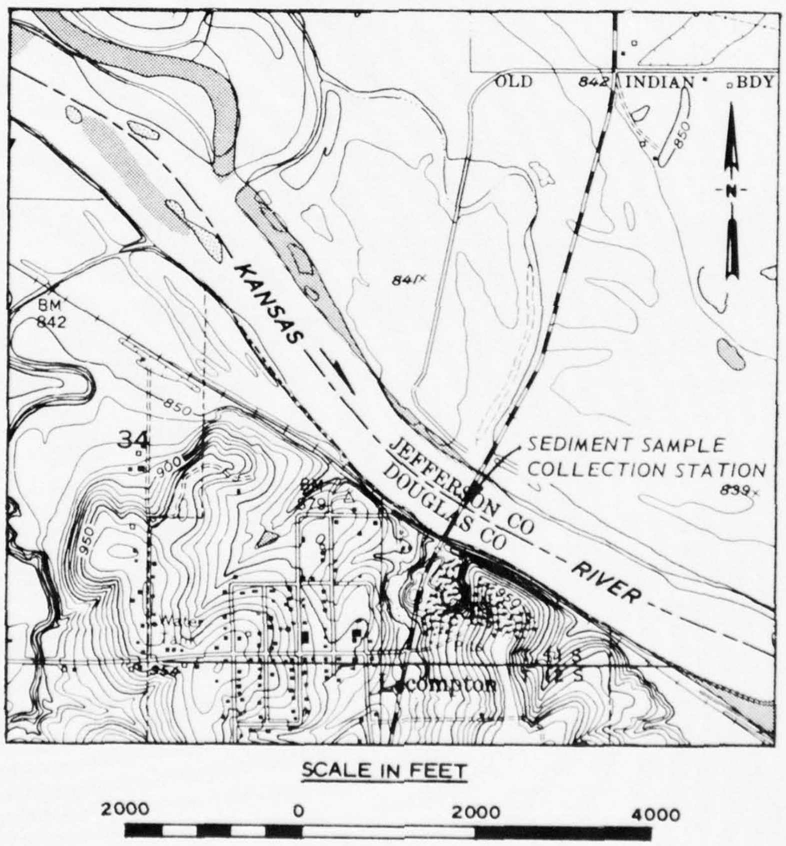

Figure A44. Site location for Lecompton, Kansas, sediment sample collection station (Source: USGS Quadrangle Map for Perry, Kansas, 1949)

Kansas River at Wamego, Kansas

Station identification

OWDC No.: 50255

Agency station No.: 06887500

Latitude/longitude: 391152/961816

Agency reporting to OWDC: USGS

River mile: 126.9 (Mile 0 is at the confluence of the Kansas and Missouri rivers; established by the CE in 1969.)

Site description

The sediment sample collection and the stream-gaging stations are on a State Highway 99 Bridge that crosses the nonnavigable (for commercial traffic) Kansas River at Wamego, Kansas, 3.0 miles downstream from Antelope Creek (Figure A45). The streambed material consists of medium-sized sands, and the gradient through this reach is 2.1 ft/mile. In this vicinity, streambanks are unprotected, and the land adjacent to and upstream from the station is used primarily for agriculture.

Streamflow and sediment loads are greatly affected by numerous upstream diversions for irrigation and control structures, the majority of which became operational between 1962 and 1969. From 1919 to 1962, the discharges of record were: maximum - 400,000 cfs; mean - 4,921 cfs; and minimum - 73 cfs. From 1969 to the present, the discharges of record are: maximum - 72,900 cfs; mean - 6,200 cfs; and minimum - 205 cfs. From 1957 to 1962, the sediment loads of record were: maximum - 752,000 tons/day; mean - 28,769 tons/day; and minimum - 16 tons/day. From 1969 to the present, the sediment loads of record are: maximum - 503,000 tons/day; mean - 15,270 tons/day; and minimum - 13 tons/day.

Station chronological record

A water-quality sample collection station was established by the USGS Kansas District at this location in August 1956. Collection of daily sediment samples began in October 1957. During the period of record, the USGS Kansas District was responsible for collecting and

analyzing the samples, as well as for reducing and reporting the resulting data.

Sample and data collection procedures

Daily sediment samples were collected from 1 October 1957 to 30 September 1975 by a paid observer; one to three depth-integrated verticals were taken using a US D-49 sampler. When two or more verticals were taken, the spacing between the verticals was determined from the distance between the centroids of equal flow (equal-discharge-increment (EDI) method).

The USGS has also collected monthly samples to determine if a correction factor had to be applied to the sediment load value calculated from the samples taken by wading and using a US DH-48 sampler. The number of verticals taken is left to the discretion of the USGS employee who must decide how many verticals are needed to characterize the often-braided cross section. The spacing between verticals is determined from the equal-transit-rate (ETR) method. During high flows, three verticals are taken monthly by the USGS using a US D-49 sampler. The spacing between the verticals is determined by the EDI method.

Daily sampling by a paid observer was discontinued after 20 September 1975, but the USGS continues to collect monthly samples in the same manner. The samplers, as well as the EDI and ETR methods, are discussed in Reference 1a.

Chemical analyses have been made on water samples collected at this site since 1955 (except for the period October 1958 - September 1961). Pesticide samples have been taken periodically at this station since March 1972.

From 25 April to 16 July 1904, a gaging station was operated at St. George, Kansas (river mile approximately 137). Stage and discharge have been measured at Wamego (mile 126.9) since 20 June 1914. The following tabulation summarizes the gaging and recording devices used at this station during the period of record and the agencies responsible for collecting these data:

Period	Device Used
U. S. Weather Bureau (now National Weather Service)*	
20 June 1914 - 31 July 1918 (intermittent readings) and 1 January 1919 - 19 August 1919 (daily readings)	Chain-and-weight gage (long box type)
1914 - ?	Staff gage
30 April 1919 - 19 August 1919	Chain-and-weight gage (long box type) (Weather Bureau property)
20 August 1919 - 1935	Chain-and-weight gage (short box type)
1934 - present	Type A wire-weight gage
1 August 1934 - present	Stevens A-35 water-stage recorder (driver by manometer since 11 October 1961)
1963 - present	Fisher-Porter automatic digital recorder (driven by manometer)

* From 20 June 1914 to about 1945, the U. S. Weather Bureau paid observers to collect the gaging data. After 1919, this agency used the devices described under USGS.

Laboratory sample analysis

Samples are analyzed at the USGS Laboratory in Lawrence, Kansas. Standard USGS procedures (and laboratory sheets) are employed to determine the concentration of suspended sediment present in each sample (Reference 1b).

Data reduction procedures

Daily sediment loads are computed by multiplying the product of the mean daily discharge (cfs) and the mean concentration (mg/ℓ) by 0.0027 to convert to tons per day. This computation was made by automated means after 1972.

Data reporting procedures

Suspended-sediment load data have been published for the period from October 1957 through 1960 in Reference 2 and for 1961 to the present in References 2 and 22. Figure A46 shows samples of the data

reported for this station. Discharge data for years prior to 1961 are in Reference 12 and for 1961 to the present in Reference 10. These data are included in the Environmental Protection Agency's STORET System.

General information

Sediment and discharge records for this station are considered good.

Additional information on this station can be obtained from: District Chief, Water Resources Division, U. S. Geological Survey, 1950 "A" - Campus West, University of Kansas, Lawrence, Kansas 66045.

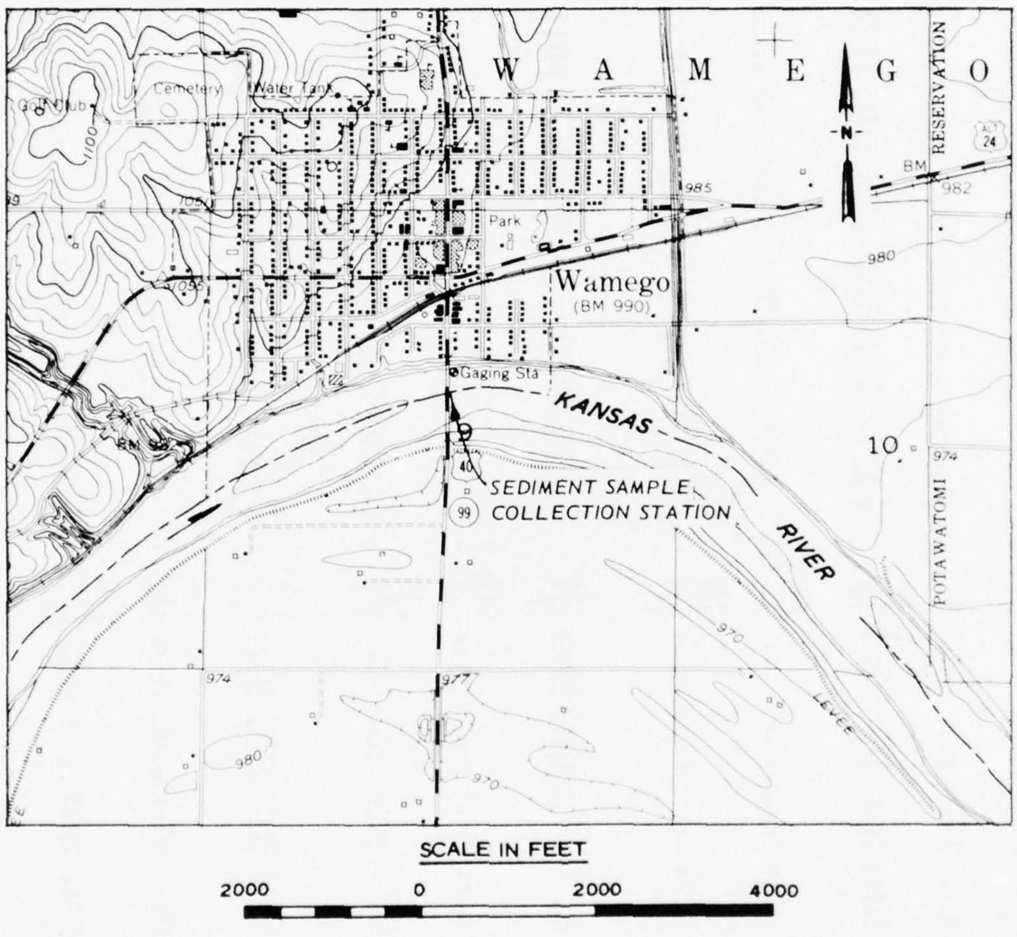

Figure A45. Site location for Wamego, Kansas, sediment sample collection station (Source: USGS Quadrangle Map for Wamego, Kansas, 1953)

KANSAS RIVER BASIN

06887500 KANSAS RIVER AT WAMEGO, KANSAS

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	2400	120	778	4430	1030	12300	1430	29	112
2	2510	112	759	4300	781	9070	1400	48	181
3	2290	116	717	3420	465	4290	1200	29	94
4	2260	153	934	3120	353	2970	1090	65	191
5	2240	107	647	3480	378	3550	1080	24	70
6	2190	103	609	2850	215	1650	1080	19	55
7	2090	91	514	2510	208	1410	1130	18	55
8	2030	87	477	2270	318	1950	1090	13	38
9	1900	84	431	2200	148	879	1070	14	40
10	1800	114	554	2420	108	706	1050	20	57
11	1810	98	479	2580	193	1340	1030	12	33
12	1650	98	437	2490	160	1080	1010	12	33
13	1900	199	1020	2350	126	799	998	12	32
14	5110	1900	26200	2160	81	472	1100	25	74
15	4300	1640	19000	2030	80	438	1240	22	74
16	2650	1230	8800	1960	64	339	1230	13	43
17	2120	946	5410	1900	61	313	1220	22	72
18	1600	703	3040	1880	61	310	1210	22	72
19	1230	481	1600	1860	66	331	1190	26	84
20	1070	318	919	1820	52	256	1170	11	35
21	1070	256	740	1800	50	243	1150	16	50
22	1240	275	921	2580	110	766	1150	18	56
23	1370	175	647	2830	101	772	1140	16	49
24	1290	112	390	2800	74	559	1190	29	93
25	1330	111	399	2780	103	773	1200	27	87
26	1690	133	607	2760	80	596	1220	15	49
27	1760	100	475	2720	66	485	1230	17	56
28	1780	81	389	1900	45	231	1190	15	48
29	2000	125	675	1480	34	136	1180	15	48
30	2540	324	2220	1450	53	207	1170	17	54
31	4240	923	10600	--	--	--	1190	19	61
TOTAL	65460	--	91388	75130	--	49221	36028	--	2096

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	1190	17	55	817	30	66	1690	100	456
2	1210	40	131	817	30	66	1880	100	508
3	1200	14	45	803	50	108	1930	100	521
4	1160	17	53	866	50	117	1680	100	454
5	1150	19	59	1100	91	270	1510	100	408
6	1130	18	55	2260	250	1530	1430	100	386
7	1130	12	37	1500	205	830	1480	100	400
8	1270	14	48	1200	79	256	1950	100	527
9	1820	103	506	1100	272	808	2060	77	428
10	1080	44	128	1100	200	594	2140	75	433
11	929	50	125	1200	150	486	2120	65	372
12	800	6	13	1250	128	432	2110	61	348
13	720	38	74	1300	74	260	2060	66	367
14	720	30	58	1300	100	351	2040	59	325
15	720	26	51	1300	100	351	2030	52	285
16	800	28	60	1300	68	239	2030	57	312
17	1000	26	70	1300	75	263	2030	77	422
18	1200	208	674	1300	94	330	1950	66	347
19	1100	88	261	1300	95	333	1870	123	621
20	1020	79	218	1400	100	378	2290	316	1950
21	943	28	71	1700	100	459	1930	159	829
22	894	27	65	1900	100	513	1690	93	424
23	901	34	83	1700	171	785	1570	103	437
24	866	21	49	1570	200	848	1450	88	345
25	845	23	52	1280	200	691	1360	69	253
26	845	20	46	1210	150	490	1340	70	253
27	831	14	31	1310	150	531	1400	80	302
28	831	16	36	1570	150	636	1420	76	291
29	831	12	27	--	--	--	1460	80	315
30	831	18	40	--	--	--	1800	77	374
31	831	20	45	--	--	--	1870	116	586
TOTAL	30798	--	3266	36753	--	13021	55570	--	14279

Figure A46. Example of sediment data for Wamego, Kansas (Source: Water Resources for Kansas, 1975, Lawrence, Kansas (sheet 1 of 2)

KANSAS RIVER BASIN

06887500 KANSAS RIVER AT WAMEGO, KANSAS--CONTINUED

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	1870	181	914	3850	191	1990	4460	328	3950
2	2940	264	2100	3750	167	1690	4690	313	3960
3	3320	164	1470	3800	161	1650	7190	488	9470
4	3290	152	1350	3660	127	1260	11400	468	14400
5	3300	133	1190	3610	131	1280	13900	494	18500
6	3230	101	881	4370	143	1690	14500	499	19500
7	3310	115	1030	4520	121	1480	14500	347	13600
8	4850	312	4090	4470	110	1330	14900	503	20200
9	5710	425	6550	4370	102	1200	17600	881	41900
10	5720	221	3410	3140	101	856	17600	643	30600
11	10000	524	14100	2930	93	736	23000	1170	72700
12	10100	410	11200	2790	89	670	19800	1250	66800
13	10100	297	8100	2120	91	521	15400	801	33300
14	10600	322	9220	1840	98	487	12800	499	17200
15	11300	311	9490	1750	129	610	12000	473	15300
16	11100	260	7790	1720	107	497	11600	387	12100
17	10900	320	9420	1710	140	646	12200	663	21800
18	10700	208	6010	1700	110	505	11300	459	14000
19	10100	169	4610	1650	106	472	11200	223	6740
20	4800	150	1940	1490	126	507	11400	325	10000
21	4140	141	1580	1320	89	317	11500	353	11000
22	3980	116	1250	1270	115	394	16100	900	39100
23	3480	107	1010	1330	201	722	18600	1410	70800
24	3310	117	1050	1130	178	543	15200	2220	91100
25	4250	378	4340	948	496	1270	17500	2480	117000
26	6370	702	12100	941	345	877	22000	2110	125000
27	5850	1440	22700	-931	128	322	22100	1650	98500
28	4790	934	12100	964	186	484	18600	1250	62800
29	4330	389	4550	1070	180	520	15400	952	39600
30	4080	251	2770	1330	259	930	13100	831	29400
31	--	--	--	3180	405	3480	--	--	--
TOTAL	181820	--	168315	73654	--	29936	431540	--	1130320

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	15200	588	24100	6450	133	2320	1920	168	871
2	15000	423	17100	4280	117	1350	1790	127	614
3	18400	495	24600	3510	93	881	1620	115	503
4	19200	585	30300	3400	154	1410	1640	128	567
5	19300	410	21400	2150	103	598	2230	570	3430
6	19600	432	22900	1800	123	598	1880	297	1510
7	19800	588	31400	1750	80	378	1310	133	470
8	19600	447	23700	1710	477	2200	1160	239	749
9	19500	482	25400	1540	112	466	1080	956	2790
10	19300	389	20300	1380	186	693	1120	450	1360
11	18900	454	23200	1350	76	277	1780	307	1480
12	12300	507	16800	1310	72	255	1520	173	710
13	9750	334	8790	1430	84	324	1400	379	1430
14	8860	737	17600	1680	80	363	1348	403	1460
15	10800	401	11700	1460	80	315	1240	251	840
16	9680	456	11900	1470	96	381	1220	200	659
17	6970	260	4890	1700	101	464	1190	159	511
18	3990	255	2750	2290	237	1470	1180	154	491
19	3110	233	1960	3890	1340	14100	1150	126	391
20	2680	203	1470	4440	1950	23400	1160	113	354
21	2490	177	1190	3790	1270	13000	1220	102	336
22	2450	193	1280	3340	686	6190	1240	89	298
23	2400	207	1340	3220	437	3800	1220	76	250
24	2310	182	1140	2930	348	2750	1200	58	188
25	5870	318	5040	2900	290	2270	1190	58	186
26	6610	208	3710	3040	251	2060	1190	115	369
27	6610	191	3410	2610	244	1720	1200	58	188
28	6130	156	2580	2270	225	1380	1260	66	225
29	5320	191	2740	1910	205	1060	1040	57	160
30	6720	154	2790	1890	191	975	989	92	246
31	6620	162	2900	1890	176	898	--	--	--
TOTAL	325470	--	370380	78780	--	88346	40679	--	23636

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 1431682
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 1984204

Figure A46 (sheet 2 of 2)

Little Sioux River Near Turin, Iowa

Site identification

OWDC No.: 5474

Agency station No.: 741

Latitude/longitude: 415755/955820

Agency reporting to OWDC: CE

River mile: 13.5 (Mile 0 is at the confluence of Little Sioux and Missouri rivers; established by the CE in 1958.)

Site description

From January 1943 to September 1951, the station was in a now-abandoned river channel. From March 1959 to July 1969, it was on a County Highway E51 Bridge that crosses the Little Sioux River 2.5 miles downstream from the confluence of the Maple and Little Sioux rivers and 3.8 miles south of Turin, or 1200 ft west of the former location (Figure A47). Artificial levees parallel both banks. There is no bank protection through this reach, and the stream is not navigable for commercial traffic. The streambed material consists of silty sand. Annual soil loss due to erosion upstream from the station is 6,000-10,000 tons/square miles. The discharges of record (1942-1973) are: maximum - 30,000 cfs; mean - 1,078 cfs; and minimum - 22 cfs. The maximum sediment loads of record (1943-1951, 1959-1969) are: maximum - 2,120,000 tons/day; mean - 8,360 tons/day; and minimum - 0 ton/day. There are no periodic diversions or storages of water above this station.

The Monona-Harrison Ditch 1 mile west of this station is a normally dry channel (a continuation of West Fort Ditch) paralleling the Little Sioux River and discharging into the Missouri River 1.5 miles upstream from the Little Sioux River confluence. An equalizer ditch 1.5 miles upstream from this station, which connected the Monona-Harrison Ditch with the Little Sioux River, was permanently closed 14 January 1958. A new diversion channel and control structure, connecting the channels of the Little Sioux River and the Monona-Harrison Ditch, was completed in December 1961. It is 9.5 miles upstream from

this station. A diversion of flow occurs only at extremely high stages.

Station chronological record

From 1943 to 1951, the station was 1200 ft east of the present location on the old river channel. In March 1959, the site was reestablished at the location of the stream-gaging station in the main channel and was operated until July 1969.

The station was established by the CE to monitor the contribution of sediment of the Little Sioux River into the Missouri River. The CE Omaha District (OD) was responsible for collecting the samples and reducing and publishing the resulting data. The samples were analyzed in the CE Missouri River Division Laboratory in Omaha.

Sample and data collection procedures

Samples were collected by the contract observers approximately 95 percent of the time and by the OD hydrographers the remainder of the time. Samples were obtained from 1943 to 1951 by using a milk bottle for surface samples and an Omaha-type sampler for point samples. Depth-integrated samples were taken (1959-1969) once every four days on one vertical during low flow, with two additional verticals (spaced equally across the stream) taken during high flow. A tabulation of the types of samplers used since 1943 is presented below:

Dates	Type of Sample	Equipment Used
1943 - 1951	Surface Point	Milk bottle Omaha-type sampler
1959 - 1969	Depth-integrated	US D-48, US D-43, US D49 samplers

The sampling apparatus was in the center of the Highway E51 Bridge in a fixed position. A hand-operated winch was used to raise and lower the depth-integrated sampler.

River stage was measured with a wire-weight gage from 1942-1958, and a Stevens Model A-35 continuous recorder from 1959-1973.

Laboratory sample analysis

Information is identical to that presented for the Boyer River (East Fork) sediment collection station at Denison, Iowa.

Data reduction procedures

Information is identical to that presented for the Boyer River (East Fork) sediment sample collection station at Denison, Iowa.

Data reporting procedures

Suspended-sediment loads and discharges have been reported by OD on a daily basis from 1939 through 1974 in Reference 11. Figures A48 and A49 show samples of data reported for this station. Discharge data were published in Reference 12 for years prior to 1961 and in References 15 and 23 for 1961 to the present. Data are also entered in WATSTORE, an automated information and retrieval program operated by the USGS.

General information

Sediment records for this station are considered to be good, with the possible exception of the samples taken with the Omaha-type sampler. The nozzle on this sampler is in the shape of a right angle, and the intake is positioned perpendicular to the streamflow during the sampling procedure. There is some question as to whether the larger sediment could follow the streamlines at the nozzle intake.

Additional information on this station can be obtained from: U. S. Army Engineer District, Omaha, Hydrologic Engineering Branch, Water Quality and Sediment Section, Federal Building, Omaha, Nebraska 68102.

Figure A47. Site location for Turin, Iowa, sediment collection station (Source: Project Maps, Omaha District, Part II, Flood Control Projects, Map No. 45, U. S. Army Engineer District, Omaha, Omaha, Nebraska, 1974)

AD-A039 571 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 8/8
INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISS--ETC(U)
MAR 77 M P KEOWN, E A DARDEAU, J G KENNEDY

UNCLASSIFIED WES-TR-M-77-1 NL

3 OF 6
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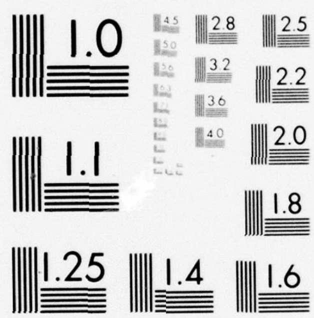


MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

LITTLE SIOUX RIVER NEAR TURIN, IOWA 6-6075

MEASURED SUSPENDED SEDIMENT LOAD IN TONS 1969 WATER YEAR

	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1	1740	3410	184	19	13	85	52900	6590	2860			
2	713	2430	160	19	13	79	169000	5840	2450			
3	468	1740	142	19	13	75	120000	5240	2120			
4	384	1190	124	19	14	74	100000	4380	1880			
5	334	1020	106	19	14	71	233000	4060	1590			
6	286	707	63	18	16	72	255000	3540	1320			
7	240	846	30	18	17	69	261000	3250	1110			
8	212	753	74	18	18	63	270000	3250	6110			
9	220	705	44	16	18	58	220000	3020	2620			
10	208	602	51	16	19	55	140000	2760	1600			
11	219	525	64	18	19	55	86600	2210	2870			
12	192	571	60	18	19	53	61300	1610	2210			
13	188	535	56	18	20	53	65600	1230	3530			
14	181	512	47	19	20	53	49700	947	2260			
15	395	549	38	20	21	53	38500	537	1860			
16	6310	559	35	23	21	104	32800	1130	1500			
17	32600	536	33	21	21	269	28400	1700	1190			
18	36600	508	32	20	22	960	26100	1940	974			
19	17300	406	32	18	22	4460	27600	2640	737			
20	13300	358	30	17	23	11400	20000	3550	589			
21	10100	396	28	16	25	22900	25700	4540	722			
22	8760	450	26	14	27	32100	25400	5170	1090			
23	8340	386	24	13	34	43500	22900	5810	1870			
24	10600	366	23	12	45	50700	19300	6460	2810			
25	11600	382	23	12	57	54800	16300	6960	7230			
26	12300	344	21	12	81	37700	13800	7940	92500			
27	10200	311	21	12	90	50300	12500	8320	174000			
28	9550	259	19	12	95	59500	11200	7720	108000			
29	9040	236	19	12		30200	9740	6060	41800			
30	6660	210	19	12		24700	7760	4520	17200			
31	4790		19	12		26600	0.0	3540				
	214114	22310	1653	516	817	459180	2541900	126764	488614			

PERIOD TOTAL 3,555,900

Figure A48. Example of sediment data for station near Turin, Iowa (Source: Suspended Sediment in the Missouri River, Daily Record for Water Years 1965-1969, U. S. Army Engineer District, Omaha, Omaha, Nebraska, May 1972)

LITTLE SIOUX RIVER BASIN

6-6075. Little Sioux River near Turin, Iowa

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	656	1,370	564	280	230	450	5,330	2,410	1,670	6,130	4,130	890
2	530	1,250	553	280	230	430	9,970	2,340	1,530	5,390	4,100	1,030
3	468	1,130	545	280	230	420	8,840	2,290	1,430	4,480	3,430	1,270
4	440	1,110	536	280	230	410	11,400	2,170	1,350	4,590	2,700	1,360
5	430	1,040	525	280	230	400	13,800	2,170	1,270	4,330	2,280	1,160
6	413	985	430	280	240	400	15,500	2,110	1,190	4,670	2,010	986
7	396	955	320	280	250	390	17,000	2,100	1,130	5,480	2,180	965
8	372	911	550	280	250	370	19,100	2,190	1,570	6,480	1,750	1,240
9	359	888	470	280	250	350	19,700	2,210	1,260	7,190	2,600	1,390
10	365	855	500	280	250	340	18,600	2,220	1,160	6,530	1,950	1,200
11	373	848	550	280	250	330	18,200	2,100	1,280	6,600	2,180	1,120
12	348	815	550	280	250	330	17,500	1,910	1,240	5,310	1,640	1,020
13	343	790	500	280	250	330	15,000	1,780	1,540	4,640	1,370	881
14	336	771	450	290	250	330	12,200	1,570	1,330	4,870	1,210	792
15	401	798	400	300	250	330	9,980	1,590	1,300	5,440	1,090	738
16	1,180	802	380	320	250	400	8,740	1,580	1,260	5,990	997	688
17	2,760	735	360	310	250	600	7,770	1,760	1,190	6,190	934	645
18	3,100	762	350	300	250	1,000	7,170	1,890	1,120	4,520	884	618
19	2,880	744	350	290	250	2,000	6,660	2,070	1,050	3,770	854	588
20	2,810	735	340	280	250	3,000	6,100	2,330	990	3,230	846	566
21	2,700	669	330	270	260	4,000	5,760	2,560	952	2,730	796	544
22	2,680	713	320	250	270	4,500	5,470	2,660	994	2,400	890	530
23	2,710	658	310	240	300	5,000	4,970	2,750	1,040	2,280	1,000	512
24	2,730	639	300	230	340	5,170	4,430	2,830	1,350	2,630	1,040	505
25	2,650	653	300	230	380	5,380	3,960	2,870	2,310	3,210	954	495
26	2,540	638	290	230	450	4,470	3,550	3,000	8,890	2,340	848	475
27	2,180	627	290	230	470	5,170	3,260	3,030	13,300	2,330	775	465
28	2,020	593	280	230	480	5,630	3,040	2,880	11,600	2,790	722	443
29	1,840	580	280	230	------	4,520	2,770	2,520	8,250	2,950	679	433
30	1,670	577	280	230	------	3,640	2,540	2,150	6,330	3,210	624	414
31	1,510	------	280	230	------	3,780	------	1,880	------	3,740	663	------
TOTAL	44,190	24,734	12,483	8,330	7,840	63,870	288,310	70,020	80,876	136,440	48,126	23,963
MEAN	1,425	824	403	269	280	2,060	9,610	2,259	2,696	4,401	1,552	799
MAX	3,100	1,370	564	320	480	5,630	19,700	3,030	13,300	7,190	4,130	1,390
MIN	336	577	280	230	230	330	2,540	1,580	952	2,280	624	414
CFSM	.40	.23	.11	.08	.08	.58	2.73	.64	.76	1.25	.44	.23
IN.	.47	.25	.13	.09	.08	.67	3.04	.74	.85	1.44	.51	.25
AC-FT	87,650	49,050	24,760	16,520	15,550	126,700	571,900	138,900	160,400	270,600	95,460	47,530

CAL YR 1968 TOTAL 131,549 MEAN 359 MAX 3,100 MIN 30 CFSM .10 IN 1.39 AC-FT 260,900
WTR YR 1969: TOTAL 809,182 MEAN 2,217 MAX 19,700 MIN 230 CFSM .63 IN 8.53 AC-FT 1,605,000

Figure A49. Example of discharge data for station near Turin, Iowa
(Source: Water resources Data for Iowa, 1969, USGS, Iowa City, Iowa)

Little Sioux River at Correctionville, Iowa

Station identification

OWDC No.: 73425

Agency station No.: 06606600

Latitude/longitude: 422820/954749

Agency reporting to OWDC: USGS

River mile: 56.0 (Mile 0 is at the confluence of the Little Sioux and Missouri rivers; established by the USGS in 1950.)

Site description

From 1950 to 1962, the station was in the center of the State Highway 31 Bridge crossing the Little Sioux River, 0.3 mile upstream from Bacon Creek, 0.5 mile west of Correctionville, Iowa, and 0.8 mile downstream from Pierson Creek (Figure A50). The topography in the vicinity of the station is hilly (glacial gravels), and farther upstream the area is loessial farmland. The right bank of this river is higher than the left bank, and it is subject to overflow. The banks are natural and relatively stable, but this stream is not navigable for commercial traffic in this reach. The site is in a straight reach of the river, and the channel gradient through this reach is 1.99 ft/mile. The streambed material is sand. Annual soil loss due to erosion upstream from the station is 6,000-10,000 tons/square mile. The discharges of record (1918-1925, 1928-1931, 1936 to the present) are: maximum - 29,800 cfs; mean - 691 cfs; and minimum - 2.6 cfs. The sediment loads of record (1950-1962) are: maximum - 257,000 tons/day; estimated mean - 1,800 tons/day; and minimum - 0 tons/day.

Station chronological record

The sediment station was established in May 1950 by the USGS and was closed in September 1962. Its operation was funded by the Iowa Geological Survey (state agency). It was in a hilly area near the headwaters of the Little Sioux River to monitor the contribution of sediment near the source of this river to the Missouri River. During the period of record, the USGS Iowa District was responsible for collecting and

analyzing samples and reducing and reporting the resulting data.

Sample and data
collection procedures

Two 1-pt samples were collected daily by a paid observer except during the ice period, when samples were obtained on alternate days. Samples were obtained several times a day during flood periods. All samples were depth-integrated and taken with either a US D-49 sampler (80 percent) or a US DH-48 sampler (20 percent); the US DH-48 was used during the winter. The US D-49 sediment sampler was in a metal shelter on the upstream side of the Highway 31 Bridge, 10 ft downstream from the gaging station. Water temperatures were also measured by the paid observer.

Gaging in the vicinity of Correctionville began on 28 May 1918 and has continued except for the periods 2 July 1925 through 28 October 1928 and 3 July 1932 through 14 June 1936. The following tabulation lists the gaging and recording devices used at Correctionville during the period of record:

Period	Locality	Device Used
28 May 1918 - 1 July 1925	Illinois Central Railroad bridge (mile 55.8)	Chain gage
29 October 1928 - 15 July 1929	Illinois Central Railroad bridge (mile 55.8)	Chain gage
16 July 1929 - 2 July 1932	Iowa State Highway 31 Bridge (mile 56.0)	Chain gage
15 June 1936 - 7 November 1938	Iowa State Highway 31 Bridge (mile 56.0)	Chain gage
8 November 1938 - present	Iowa State Highway 31 Bridge (mile 56.0)	Stevens A-35 water-stage recorder
? - present	Iowa State Highway 31 Bridge (mile 56.0)	Type A wire-weight gage
? - present	Iowa State Highway 31 Bridge (mile 56.0)	Enameled staff gage
? - present	Iowa State Highway 31 Bridge (mile 56.0)	Digital punch-tape water-stage recorder*

* With attachment that enables query by the National Weather Service.

Laboratory sample analysis

Information is identical to that presented for the Cedar River sediment sample collection station at Cedar Rapids, Iowa, except that two individual samples were composited prior to analysis.

Data reduction procedures

Information is identical to that presented for the Boyer River sediment sample collection station at Logan, Iowa, except that sediment load computations were performed manually.

Data reporting procedures

Discharge has been reported by the USGS Iowa District during the periods of 1918-1925, 1928-1932, and 1936 to the current year and published for years prior to 1961 in Reference 12 and for years since 1961 in Reference 15. Sediment data are published in Reference 16. Figure A51 is an example of these data.

General information

The record is considered to be good except for winter periods, which are poor.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

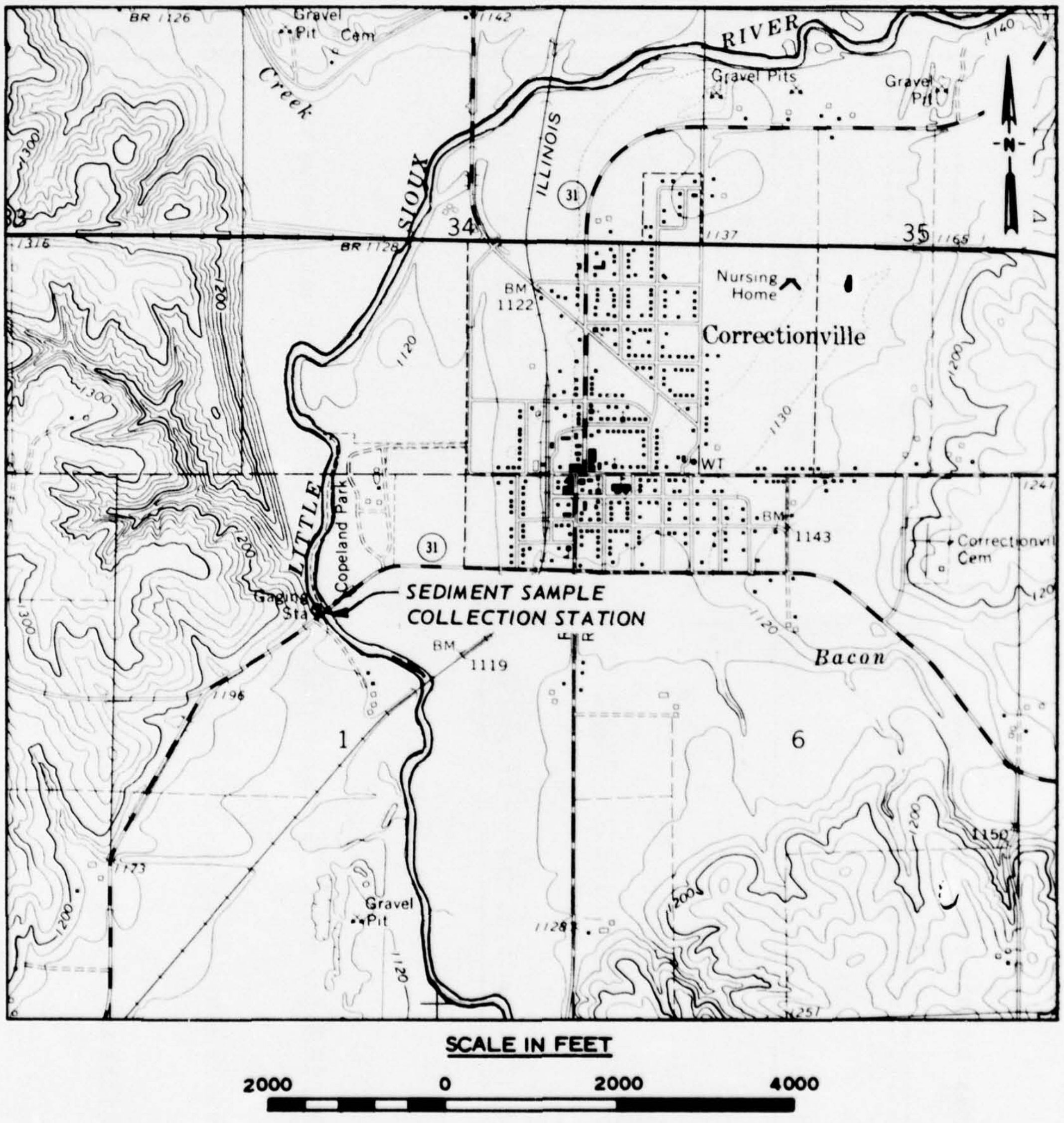


Figure A50. Site location for Correctionville, Iowa, sediment sample collection station (Source: USGS Quadrangle Map for Correctville, Iowa, 1969)

MISSOURI RIVER BASIN
LITTLE SIOUX RIVER BASIN
6-6066. LITTLE SIOUX RIVER AT CORRECTIONVILLE, IOWA--

Suspended sediment, water year October 1958 to September 1959

Day	Mean Discharge (cfs)	Mean Concentration (ppm)	Tons/day	Mean Discharge (csf)	Mean Concentration (ppm)	Tons/day	Mean Discharge (cfs)	Mean Concentration (ppm)	Tons/day
	October			November			December		
1	9.0	21		22	--		21	15	
2	9.0	--		22	32		22	17	
3	9.0	36	a 1	22	--	a 2	23	--	a 1
4	9.0	42		22	41		23	13	
5	10.0	52		22	--		22	--	
6	11.0	63	a 2	22			20	49	
7	11.0	50		23			16	--	
8	11.0	--		24			15	54	a 2
9	12.0	76	2	25			14	--	
10	14.0	--	e 3	25	24	2	14	34	
11	11.0	49		24			13	--	
12	11.0	--		23			13	47	
13	11.0	64		24			12	--	
14	11.0	--		25	43	3	12	43	
15	12.0	84		25	50	3	12	--	
16	11.0	--		26	63	4	13	48	
17	10.0	75		27	73	5	13	--	
18	10.0	--	a 2	28			13	30	
19	12.0	73		28			14	--	
20	12.0	--		33			14	33	
21	13.0	85		33			14	--	a 1
22	13.0	--		32			14	32	
23	14.0	83		31			14	--	
24	13.0	--		31	16	1	14	--	
25	14.0	49	2	32			14	--	
26	25.0	--	e 5	24			14	27	
27	17.0	42		23			14	--	
28	17.0	--	a 2	21			14	44	
29	17.0	42		20			13	--	
30	25.0	--	e 5	20			12	29	
31	22.0	42	2	--	--	--	12	--	
Total	406.0	--	65	759	--	54	468	--	36

Day	Mean Discharge (cfs)	Mean Concentration (ppm)	Tons/day	Mean Discharge (csf)	Mean Concentration (ppm)	Tons/day	Mean Discharge (cfs)	Mean Concentration (ppm)	Tons/day
	January			February			March		
1	11.0	25		6.8	--		50	--	e 1
2	11.0	--		6.8	12		90	77	19
3	10.0	16	a 1	6.8	30		100	20	5
4	10.0	--		6.8	59		110	33	10
5	9.5	17		6.8	--		90	30	7
6	9.5	--		7.0	--		70	41	8
7	9.5	20		7.0	44		80	20	3
8	9.5	15		7.0	46		55	30	4
9	9.5	52		7.0	--		50	19	3
10	9.0	--	a 1	7.0	48		45	13	2
11	9.0	42		7.0	--		40	6	1
12	8.5	--		7.0	--		35	9	1
13	8.5	37		7.0	--		35	53	5
14	8.5	--		7.0	32		70	27	5
15	8.5	41		7.0	--	a 1	55	20	3
16	8.0	--		7.0	68		50	11	1
17	8.0	58		7.0	--		45	12	1
18	8.0	--		6.8	31		45	9	1
19	7.4	37		6.5	--		50	47	6
20	7.4	--		6.5	32		60	20	3
21	7.4	57		6.5	--		50	22	3
22	7.4	--		6.5	38		47	27	3
23	7.4	31		6.5	--		48	88	11
24	7.4	--	a 1	7.0	31		266	160	115
25	6.8	29		8.0	--		257	130	90
26	5.8	--		8.0	26		311	190	160
27	6.8	25		9.0	--		330	160	143
28	6.8	--		9.0	47		311	135	113
29	6.8	18		--	--	--	330	135	120
30	6.8	--		--	--	--	284	130	100
31	6.8	15		--	--	--	257	98	68
Total	257.5	--	31	198.3	--	28	3,694	--	1,015

(Continued)

e Estimated.
a Computed from samples obtained three or four times a wee
s Computed by subdividing day.
b Computed from partly estimated concentration graph.

Figure A51. Example of sediment data for Correctionville, Iowa (Source: Quality of Surface Waters of the United States, Parts 5 and 6, USGS, 1959, Iowa City, Iowa (sheet 1 of 2)

MISSOURI RIVER BASIN
LITTLE SIOUX RIVER BASIN
6-6066. LITTLE SIOUX RIVER AT CORRECTIONVILLE, IOWA--

Suspended sediment, water year October 1958 to September 1959
(Concluded)

Day	Mean Discharge (cfs)	Mean Concentration (ppm)	Tons/day	Mean Discharge (csf)	Mean Concentration (ppm)	Tons/day	Mean Discharge (cfs)	Mean Concentration (ppm)	Tons/day
	April			May			June		
1	240	100	65	72	96	19	4,720	2,750	s 35,600
2	232	80	50	66	88	16	2,770	1,700	12,700
3	223	83	50	74	82	16	2,280	1,160	7,140
4	211	71	40	86	95	22	2,180	1,080	6,360
5	196	89	47	121	130	42	2,280	1,060	6,530
6	184	84	42	266	250	180	2,790	1,060	6,530
7	172	105	49	360	270	262	3,440	1,020	9,470
8	164	76	34	380	220	226	3,580	890	8,600
9	146	41	16	420	280	318	3,100	805	6,740
10	136	47	17	991	4,760	s 13,000	2,390	710	4,580
11	130	37	13	829	1,780	s 4,410	2,660	6,250	s 67,100
12	122	55	18	831	685	1,170	1,560	840	3,540
13	114	35	11	518	580	811	1,220	560	1,840
14	106	54	15	430	405	470	1,050	510	1,450
15	103	86	24	370	310	310	916	425	1,050
16	98	90	24	320	275	238	805	370	804
17	104	87	24	293	260	206	730	315	621
18	113	65	20	266	245	176	670	290	525
19	107	40	12	248	270	181	670	310	561
20	134	37	13	330	1,800	sb 1,800	631	350	596
21	158	61	26	546	3,810	s 5,920	592	340	543
22	144	93	36	775	2,850	5,960	579	205	320
23	131	96	34	860	1,700	3,950	529	230	329
24	118	77	25	1,290	2,100	7,310	496	185	248
25	106	75	21	1,650	1,560	6,950	463	185	231
26	95	66	17	1,650	1,050	4,680	430	190	221
27	92	70	17	1,010	950	2,590	418	270	305
28	87	64	15	1,730	8,100	sb 110,000	860	3,100	8,800
29	82	69	15	3,300	9,700	sb 110,000	1,520	3,900	16,000
30	76	79	16	1,550	4,000	sb 23,000	1,560	4,010	16,900
31	--	--	--	6,580	12,000	sb 220,000	--	--	--
Total	4,124	--	806	28,012	--	524,233	47,889	--	227,694
	June			August			September		
1	1,440	1,830	7,120	110	145	43	90	77	19
2	1,220	1,050	3,460	160	1,100	sb 650	90	115	28
3	1,080	760	2,220	1,400	3,800	b 14,000	84	73	17
4	916	575	1,420	869	1,370	s 3,270	78	83	17
5	760	470	964	553	1,230	1,840	76	87	18
6	644	400	696	471	800	1,020	76	93	19
7	566	350	535	693	2,150	4,020	74	79	16
8	496	315	422	380	680	698	66	73	13
9	452	270	329	302	305	249	60	78	13
10	400	215	232	240	140	91	56		
11	360	175	170	206	180	100	53		
12	330	145	129	180	150	73	51	58	8
13	330	165	147	160	135	58	50		
14	320	260	225	172	175	81	48		
15	311	185	155	205	140	77	46		
16	284	190	146	214	130	75	47		
17	276	240	sb 190	201	125	68	54		
18	351	700	sb 750	180	82	40	57	40	6
19	302	545	444	161	75	33	58		
20	257	260	180	140	67	25	75	360	sb 220
21	232	185	116	125	75	25	376	2,000	sb 2,900
22	209	145	82	115	83	26	141	300	114
23	192	150	78	107	78	23	96	210	54
24	177	145	69	103	80	22	96	180	45
25	164	155	69	98	82	22	95	145	37
26	152	155	64	112	98	30	107	135	39
27	142	145	56	100	94	25	117	205	65
28	134	155	56	108	86	25	142	115	44
29	125	150	51	108	86	25	121	62	20
30	121	155	51	106	83	24	106	40	11
31	114	145	45	94	78	20	--	--	--
Total	12,857	--	20,671	8,173	--	26,778	2,686	--	3,781

Total discharge for year (cfs-days).......................109,523.8
Total load for year (tons)................................805,192.0
s Computed by subdividing day.
b Computed from partly estimated concentration graph.

Figure A51 (sheet 2 of 2)

Mississippi River at New Orleans (Carrollton), Louisiana

Station identification

OWDC No.: 73760

Agency station No.: 01300

Latitude/longitude: 295605/900810

Agency reporting to OWDC: CE

River mile: 106.2 (Mile 0 is at the Head of Passes near the mouth of the Mississippi River; established by the CE in 1962.)

Site description

The New Orleans (Carrollton), Louisiana, sediment sample collection station (operated as a periodic high-flow station) is along the Carrollton Discharge Range of the CE New Orleans District (NOD) (Figure A52). It is 0.1 mile upstream from the Huey P. Long (U. S. Highway 90) Bridge, which links major commercial and industrial areas of metropolitan New Orleans. Although the bulk of the activity of the Port of New Orleans is downstream from this sampling station, there are in excess of 20 commercial installations along both banks within 20 miles upstream of this sampling range. Both banks are protected with articulated concrete matting along the cut banks, and artificial levees parallel both banks. Commercial traffic (including ocean-going vessels) is very heavy, since the Port of New Orleans ranks second (in terms of tonnage) in the United States. The streambed material consists mainly of fine sands and very fine sands, and the approximate channel gradient in this reach is 0.02 ft/mile. The discharges of record (12 January 1872 to the present) at the New Orleans (Carrollton) gage (mile 102.8) are: maximum - 1,557,000 cfs; mean - 425,000 cfs; and minimum - 49,200 cfs. Natural flow at this station is affected by tides. Suspended-sediment load measurements were made only during the high-flow periods of 1973 and 1975. The maximum load measured was 1,918,000 tons/day measured 10 April 1973. No mean or minimum values are given since the period of record covered only high flows.

Station chronological record

This station was established to obtain sediment load data for this reach of the Mississippi River during the high-flow periods of April through June 1973 and March through May 1975. Sample collection, data reduction, and data publication were the responsibility of the NOD. Laboratory analysis was handled by the NOD during 1973 and by the USGS Louisiana District during 1975.

Sample and data collection procedures

Discharges were determined and point-integrated suspended-sediment samples were collected by the NOD personnel along the Carrollton Discharge Range (mile 106.2) during 1973 and 1975. Stream velocity measurements made prior to sediment sampling were taken with either a Price or a Gurley current meter, and the discharges computed from these measurements were used to determine the position of the sampling verticals. On 31 days during April through June 1973, samples were collected with a US P-46 sampler on three verticals at depths of 1 ft and at 25, 50, and 75 percent of the total vertical depth. On 13 days during the period of 28 March through 21 May 1975, samples were taken on seven verticals with a US P-61 sampler at 15, 30, 50, 70, and 90 percent of the depth. Bed-material samples were collected with a drag bucket only during 1975.

The USGS Louisiana District has collected water-quality data at its New Orleans station at the Carrollton Street Municipal Water Plant (mile 104.0) since 1967.

Laboratory sample analysis

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reduction procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana, except that no interpolations were made for days of missing sediment record.

Data reporting procedures

No sediment data were ever published in any form. Figure A53 is

a printout provided by the NOD from its records. Discharge data are published in Reference 24. All water-quality data collected by the USGS are published in Reference 5.

General information

Further information regarding this station can be obtained from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, La. 70160.

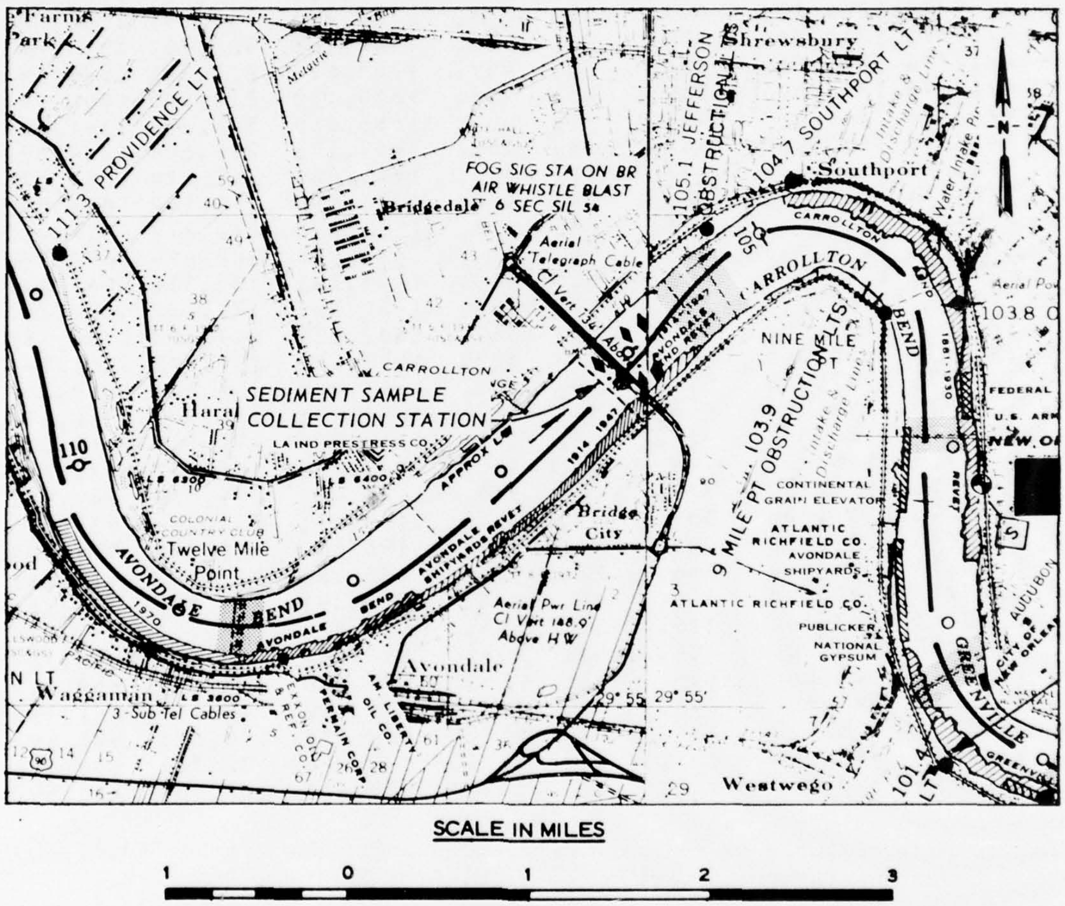


Figure A52. Site location for New Orleans (Carrollton), Louisiana, sediment sample collection station (Source: Maps Nos. 51 and 52, Flood Control and Navigation Maps of the Mississippi River, Mississippi River Commission, Vicksburg, 1973)

MISSISSIPPI RIVER AT NEW ORLEANS, LA.
SUSPENDED SEDIMENT OBSERVATIONS

DATE MO DA YR	Q 1000 CFS	P.P.M. TOT	P.P.M. SAND	P.P.M. SILT	1000 TONS/DAY TOTAL	1000 TONS/DAY SAND	1000 TONS/DAY SILT
4/ 6/73	1152.000	498.	72.	426.	1547.356	224.228	1323.128
4/ 9/73	1224.000	542.	79.	464.	1790.220	259.697	1530.523
4/10/73	1230.000	575.	99.	476.	1906.163	328.700	1577.463
4/12/73	1248.000	524.	65.	459.	1764.678	219.525	1545.153
4/14/73	1207.000	559.	65.	493.	1818.182	212.085	1606.097
4/17/73	1240.000	498.	91.	407.	1665.858	304.254	1361.604
4/19/73	1150.000	467.	65.	401.	1447.171	202.348	1244.822
4/21/73	1063.000	447.	87.	360.	1281.849	249.674	1032.176
4/23/73	1087.000	421.	75.	346.	1233.054	219.169	1013.885
4/25/73	1062.000	403.	85.	318.	1153.690	242.279	911.411
4/27/73	1082.000	458.	83.	374.	1334.960	242.670	1092.290
4/29/73	1052.000	403.	65.	338.	1143.763	183.516	960.247
5/ 2/73	1047.000	361.	60.	301.	1020.395	170.136	850.258
5/ 5/73	1127.000	438.	81.	357.	1332.251	247.383	1084.868
5/ 8/73	1238.000	462.	87.	375.	1543.489	291.745	1251.744
5/10/73	1191.000	501.	79.	421.	1607.449	255.201	1352.248
5/12/73	1146.000	456.	64.	392.	1409.318	196.947	1212.370
5/14/73	1166.000	418.	62.	356.	1313.928	194.913	1119.014
5/16/73	1146.000	403.	55.	348.	1244.726	168.887	1075.839
5/18/73	1136.000	382.	72.	310.	1171.495	221.574	949.921
5/20/73	1137.000	388.	83.	305.	1188.531	253.656	934.875
5/23/73	1107.000	401.	73.	327.	1195.560	218.156	977.404
5/26/73	1096.000	366.	57.	308.	1080.888	169.587	911.301
5/28/73	1099.000	336.	69.	268.	996.391	203.125	793.266
5/30/73	1097.000	318.	50.	268.	941.774	149.360	792.414
6/ 2/73	1069.000	288.	51.	238.	831.139	146.412	684.727
6/ 5/73	1008.000	255.	46.	209.	693.876	124.657	569.219
6/10/73	941.000	240.	46.	194.	609.692	117.919	491.773
6/12/73	875.000	292.	43.	250.	689.178	100.375	588.802
6/17/73	965.000	263.	51.	212.	683.428	132.767	550.662
6/21/73	952.000	224.	41.	183.	575.231	104.639	470.592

Figure A53. Example of sediment data for New Orleans (Carrollton), Louisiana (printout prvided by U. S. Army Engineer District, New Orleans)

Mississippi River at Baton Rouge, Louisiana

Station identification

OWDC No.: Number to be assigned

Agency station No.: 01165

Latitude/longitude: 303025/911155

Agency reporting to OWDC: CE

River mile: 233.8 (Mile 0 is at the Head of Passes near the mouth of the Mississippi River; established by the CE in 1962.)

Site description

The sediment sample collection station is at the Baton Rouge Discharge Range (mile 233.8) approximately 100 ft downstream from the Baton Rouge highway and railroad bridge (U. S. Highway 190 and Kansas City Southern Railroad) (Figure A54). Associated with this sampling station is the Baton Rouge gage at mile 228.4 near the right bank on the south wall of the Port Allen Lock of the Morgan City-Port Allen Route of the Intracoastal Waterway. Upstream from the sampling station are sharp bends at mile 235.0 and mile 240.0. From mile 244.0 to mile 240.0, the river flows southwest, bends sharply and flows northeast to mile 235.0, then bends once more and flows due south to mile 229.0. The banks are protected by articulated concrete matting from mile 230.1 to mile 233.8 (right bank), from mile 237.4 to mile 240.3 (right bank), and from mile 241.5 to mile 245.9 (left bank). Artificial levees parallel both banks. The majority of the commercial and industrial activity of Baton Rouge is downstream from the sampling station; however, there are a significant number of industrial sites upstream and adjacent to the station, including an aluminum plant, a cement plant, and several petrochemical plants. The mouth of Baton Rouge Harbor Channel is at mile 235.3. River traffic (including ocean-going vessels) is very heavy, since the Port of Baton Rouge ranks fifth (in terms of total tonnage) in the United States. The streambed in this reach consists of fine and medium sands, and the approximate channel gradient is 0.06 ft/mile. The discharges of record (1929 and 1938-1957) are: maximum - 1,473,000 cfs;

mean - 460,000 cfs; and minimum - 73,700 cfs. The sediment loads of record (October 1949 - Feburary 1958, March-May 1975, and February-March 1976) are: maximum - 4,966,210 tons/day; mean - 863,900 tons/day, and minimum - 4,010 tons/day.

Station chronological record

This station was established in October 1949 as a permanent discharge station to monitor sediment loads in this reach of the Mississippi River; it was discontinued in February 1958. During March-May 1975 and February-March 1976, it was used to monitor sediment loads during periods of high flow. It will be used as necessary in the future for this purpose. Sample collection was the responsibility of the CE New Orleans District (NOD) from 1949-1958: the USGS Louisiana District collected samples during 1975 and 1976. Laboratory analysis was handled by the NOD from 1949-1958 and by the USGS Louisiana District during 1975 and 1976. Data reduction and data publication are handled by the NOD.

Sample and data collection procedures

From October 1949 to February 1958, the NOD personnel collected point-integrated, suspended-sediment samples with a US P-49 sampler at selected verticals at this station. During March-May 1975 and February-March 1976, the USGS collected these samples with a US P-61 sampler. The NOD personnel took suspended-sediment and bed-material samples once weekly, except on those days when the river stage exceeded 52 ft, at which time samples are taken every other day. A total of 40 point-integrated, suspended-sediment samples were taken for 2 min each (i.e. five samples along eight verticals at 10, 25, 50, 75, and 90 percent of the depth of the vertical). The verticals were taken at fixed intervals from a reference point on the bank. The locations of these verticals were based on discharge data; they were shifted periodically as discharge patterns changed. The bed-material sample was taken at each vertical with a drag bucket.

The river stage has been read daily since 1872. The discharges were computed from these gage readings and rating curves were developed for this reach of the Mississippi River for the periods 1931-1945 and

1947-1956. Discharge computations are also made from velocity measurements taken periodically since 1929 by both the NOD and the USGS Louisiana District.

The USGS began collecting periodic water-quality samples in July 1975. The samples were analyzed for their chemical constituents.

Laboratory sample analysis

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reduction procedures

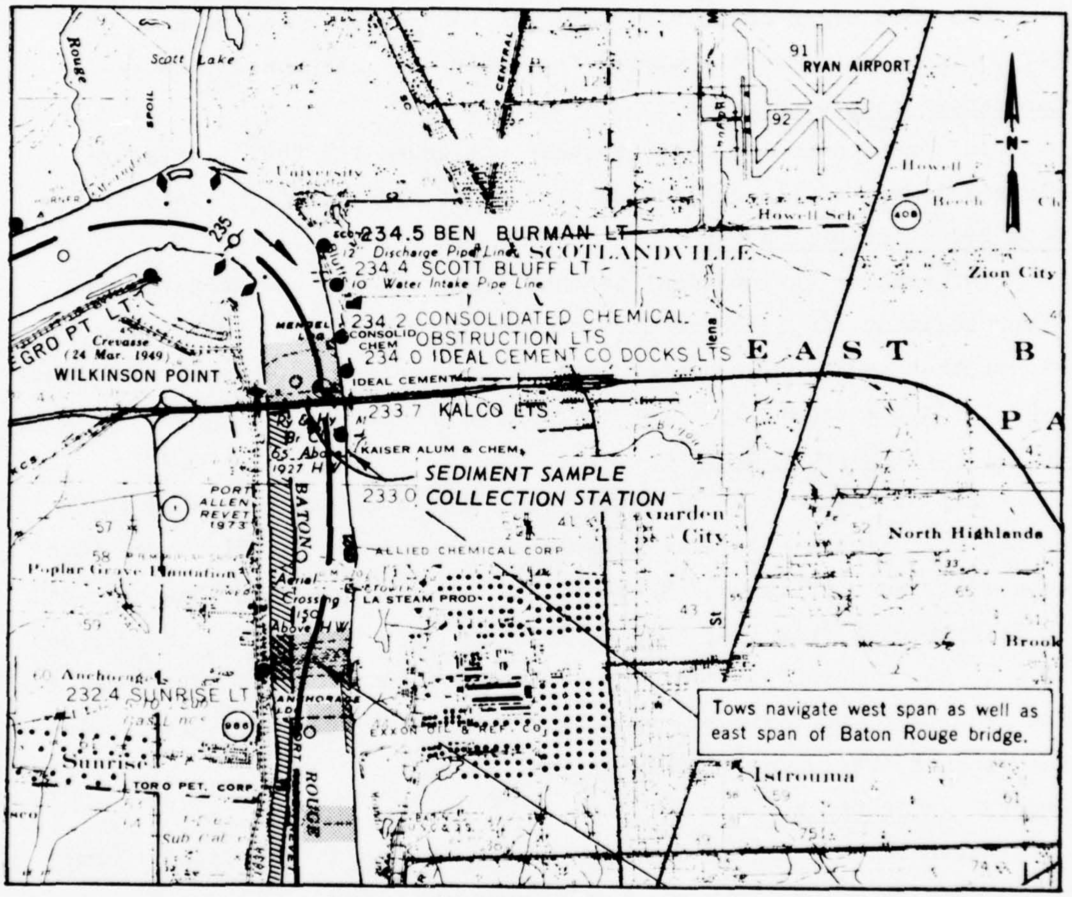
Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana, except that sediment load computations on samples collected from October 1949 through February 1958 were performed manually.

Data reporting procedures

Only sediment data for water year 1975 have been published (Reference 5). Figure A55 is an example of these data. No discharge data have ever been published, except for instantaneous values that appeared in Reference 12 from 1941 through 1958 and in Reference 25 for 1975 and 1976 to the present. Daily gage heights are published in Reference 24. The results of periodic water-quality analyses have been published in Reference 25 beginning with water year 1975.

General information

Further information regarding this station can be obtained from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, Louisiana 70160.



SCALE IN MILES

1 0 1 2 3

Figure A54. Site location for Baton Rouge, Louisiana, sediment sample collection station (Source: Map No. 46, Flood Control and Navigation Maps of the Mississippi River, Mississippi River Commission, Vicksburg, Mississippi, 1973)

INSTANTANEOUS SUSPENDED-SEDIMENT DISCHARGE MEASUREMENTS, WATER YEAR 1975

MISSISSIPPI RIVER MAIN STEM

07374000 MISSISSIPPI RIVER AT BATON ROUGE, LA.

DATE	TIME	INSTANTANEOUS DISCHARGE (CFS)	SUSPENDED SEDIMENT (MG/L)	SUSPENDED SEDIMENT DISCHARGE (T/DAY)	SUS. SED. SIEVE DIAM. % FINER THAN .062 MM
MAR.					
25...	1300	998000	523	1410000	43
APR.					
01...	1300	988000	293	782000	60
05...	1430	1180000	336	1070000	45
08...	1330	1220000	340	1120000	51
15...	1500	1210000	311	1020000	45
18...	1400	1220000	202	665000	61
21...	1230	1270000	261	895000	43
24...	1200	1110000	212	635000	53
28...	1200	997000	219	590000	59
MAY					
01...	1130	904000	335	818000	80
05...	1100	879000	345	819000	73
09...	1100	938000	363	919000	71
12...	1000	964000	290	755000	66
16...	1100	949000	212	543000	73
19...	1100	1000000	220	594000	61
23...	1100	907000	221	541000	59

Figure A55. Example of sediment data for Baton Rouge, Louisiana (Source: Water Resources Data for Louisiana, 1975, USGS, New Orleans, Louisiana)

Mississippi River at Tarbert Landing, Mississippi

Station identification

OWDC No.: 54880

Agency station No.: 01100

Latitude/longitude: 310030/913725

Agency reporting to OWDC: CE

River mile: 306.3 (Mile 0 is at the Head of Passes near the mouth of the Mississippi River; established by the CE in 1962.)

Site description

From March 1958 to June 1963, this sediment sample collection station was downstream from its present position at the Red River Landing, Louisiana, Discharge Range (mile 301.7). Since June 1963, its location has been identical to that of the Tarbert Landing, Mississippi, Discharge Range (mile 306.3). The Tarbert Landing station is along a straight reach of the Mississippi River, 0.25 mile north of the Louisiana State line, 2.3 miles upstream from the mouth of the Lower Old River, and 8.2 miles downstream from the Old River Control Structure on the Old River Outflow Channel connecting the Mississippi River with the Red and Atchafalaya rivers. (The Old River Control Structure passes about 25 percent of the Mississippi River discharge, but not a proportional amount of sediment.) Both locations are shown in Figure A56. The streambed material consists of fine sands. The left (or Mississippi) bank is protected with articulated concrete matting (Fort Adams Reach Revetment) from mile 306.7 to mile 309.8, and the right (or Louisiana) bank is protected with the same material (Point Breeze Revetment) from mile 313.3 to mile 314.5. (The entrance to the Old River Outflow Channel is at mile 314.5.) An artificial levee parallels the right bank for the entire reach. The only levee on the left bank is one protecting the Louisiana State Penal Farm, and the majority of it is downstream from the present sediment station. The distance from the left bank to the bluff line along this reach ranges from 0 to slightly over 2 miles. Approximate channel gradient in this reach is 0.2 ft/mile. The Red

River Landing gage is associated with the Tarbert Landing site; the discharges measured during its period of record (1911-1913, 1928, 1929, and 1932 to the present) are: maximum - 1,977,000 cfs; mean - 454,000 cfs; and minimum - 85,000 cfs. The sediment loads of record (March 1958 through June 1963 at Red River Landing and June 1963 to the present at Tarbert Landing) are: maximum - 3,744,000 tons/day; mean - 455,000 tons/day; and minimum - 20,000 tons/day.

Station chronological record

The sediment sampling station was established in March 1958 by the CE New Orleans District (NOD) at the Red River Landing, Louisiana, Discharge Range to obtain data on sediment loads in the Mississippi River downstream from the Lower Old River (mile 301.3). In July 1963, the sediment station was relocated at Tarbert Landing, Mississippi (mile 306.3), after the Lower Old River was closed and the Lower Old River Lock was put into operation at Lower Old River-Red River mile 1.4. Sample collection, data reduction, and data publication are the responsibility of the NOD. Sediment samples were analyzed by the Testing Section (now known as Field Investigations and Testing Section), Foundations and Materials Branch, NOD, from March 1958 through June 1973. Since June 1973, the USGS Louisiana District has analyzed samples at the Baton Rouge, Louisiana, Laboratory.

Sample and data collection procedures

Prior to 13 April 1974, suspended-sediment samples were taken with a US P-46 sampler, and since that date, a US P-61 sampler has been used. Procedures for collecting these samples and bed-material samples are identical to those presented for Mississippi River sediment sample collection station at Baton Rouge, Louisiana.

Discharge is measured at the Tarbert Landing Discharge Range on days when suspended-sediment samples are taken. Daily stage readings are obtained from the gage at Red River Landing, Louisiana (mile 302.4), by a paid observer. Prior to 1961, a wire-weight gage was used. In 1961, a Stevens A-35B recorder driven by a manometer was installed at the Red River Landing site.

Laboratory sample analysis

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reduction procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reporting procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana. An example of data for Tarbert Landing is shown in Figure A57. Discharge data for the Tarbert Landing station have been published in Reference 25 since water year 1973 and in Reference 24 throughout the period of record. Reference 25 also contains daily stage data from the Red River Landing gage.

General information

Additional information on this station can be obtained from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, Louisiana 70160.

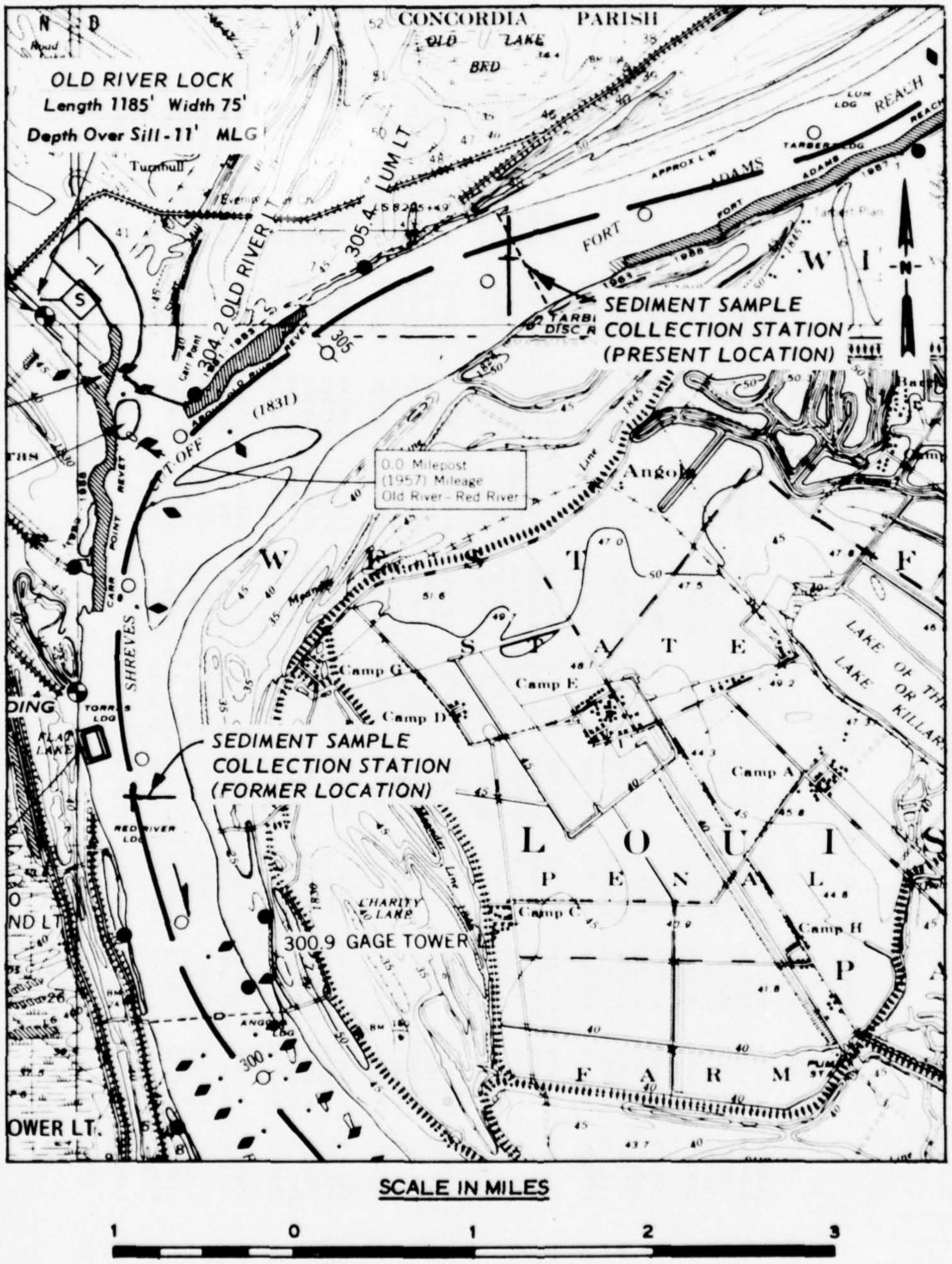


Figure A56. Site locations for Tarbert Landings, Mississippi, sediment sample collection stations (Source: Map No. 42, Flood Control and Navigation Maps of the Mississippi River, Mississippi River Commission, Vicksburg, Mississippi, 1973)

LOWER MISSISSIPPI RIVER BASIN

MISSISSIPPI RIVER MAIN STEM

07295100 MISSISSIPPI RIVER AT TARBERT LANDING, MISS.

SUSPENDED-SEDIMENT DISCHARGE (T/DAY), WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	143000	213000	780000	1050000	1150000	690000	1100000	687000	564000	433000	342000	144000
2	142000	215000	733000	985000	1190000	674000	1090000	744000	558000	424000	374000	140000
3	146000	233000	688000	929000	1140000	659000	1140000	751000	549000	440000	377000	138000
4	151000	260000	643000	853000	1090000	645000	1180000	794000	539000	459000	374000	138000
5	155000	303000	605000	782000	1040000	629000	1210000	797000	541000	475000	366000	137000
6	157000	353000	568000	793000	988000	619000	1260000	753000	579000	448000	352000	136000
7	160000	403000	529000	812000	936000	620000	1310000	712000	586000	424000	337000	134000
8	165000	451000	494000	830000	891000	620000	1340000	655000	580000	405000	319000	132000
9	170000	515000	464000	847000	868000	623000	1350000	681000	557000	380000	298000	131000
10	175000	589000	435000	863000	844000	636000	1220000	781000	551000	361000	278000	129000
11	180000	666000	415000	879000	817000	665000	1140000	905000	529000	336000	256000	129000
12	184000	733000	398000	898000	798000	685000	1100000	890000	587000	316000	237000	130000
13	192000	809000	383000	914000	798000	724000	821000	829000	637000	306000	221000	131000
14	199000	888000	464000	928000	809000	781000	661000	780000	579000	295000	210000	129000
15	203000	962000	567000	947000	815000	846000	748000	796000	536000	287000	202000	126000
16	207000	1030000	694000	945000	817000	889000	881000	848000	504000	275000	196000	124000
17	208000	1020000	844000	951000	816000	930000	984000	835000	454000	266000	189000	122000
18	208000	1010000	1030000	952000	818000	955000	1160000	850000	410000	255000	184000	120000
19	209000	989000	1260000	948000	820000	973000	1000000	809000	483000	245000	185000	122000
20	206000	997000	1550000	934000	809000	997000	944000	801000	553000	246000	186000	118000
21	203000	983000	1930000	925000	803000	1030000	785000	772000	514000	246000	188000	113000
22	202000	980000	1820000	907000	796000	1040000	858000	745000	477000	247000	188000	119000
23	199000	970000	1720000	897000	788000	1070000	910000	658000	440000	247000	186000	116000
24	195000	962000	1630000	874000	783000	1130000	944000	586000	455000	248000	186000	113000
25	194000	944000	1550000	877000	774000	1180000	997000	566000	482000	248000	185000	112000
26	195000	921000	1470000	893000	763000	1200000	969000	600000	439000	249000	182000	113000
27	201000	895000	1400000	920000	744000	1180000	996000	576000	390000	243000	179000	111000
28	203000	875000	1320000	958000	717000	1160000	883000	602000	411000	245000	168000	167000
29	206000	854000	1250000	1000000	---	1150000	852000	584000	403000	254000	157000	253000
30	211000	827000	1180000	1040000	---	1130000	804000	557000	439000	273000	152000	389000
31	211000	---	1110000	1090000	---	1110000	---	556000	---	305000	149000	---
MONTH	186520	728030	965290	916810	872210	878710	1021230	725840	510870	318740	238810	140530

YEAR TOTAL - 228,000,000 TONS PERCENT FINER THAN .062 - 153,000,000 TONS

MAX 1,930,000 MIN 111,000 MEAN 623,550

Figure A57. Example of sediment data for Tarbert Landing, Mississippi (Source: Water Resources Data for Louisiana, 1973, USGS, New Orleans, Louisiana)

Mississippi River near Coochie, Louisiana

Station identification

OWDC No.: 54881

Agency Station No.: 01020

Latitude/longitude: 310552/913612

Agency Reporting to OWDC: CE

River mile: 317.2 (Mile 0 is at the Head of Passes near the mouth of the Mississippi River; established by the CE in 1962.)

Site description

The sediment sample collection station near Coochie, Louisiana, is along the Coochie Discharge Range (mile 317.2) of the CE New Orleans District (NOD) (Figure A58). It is 2.7 miles upstream from the Old River Outflow Channel. Along the right (or Louisiana) cut bank in the vicinity of the station is articulated concrete matting (Coochie Revetment). There is also articulated concrete matting (Palmetto Revetment) along the left (or Mississippi) cut bank upstream from mile 319.3 to mile 323.9. An artificial levee parallels the right bank; there are no levees along the left bank, except for some secondary levees protecting plantation interests below the bluff line (5 to 10 miles from the Mississippi River). Except for some oil and gas wells in both Louisiana and Mississippi, there is virtually no industrial activity upstream from the station. The economy is based on limited agricultural and grazing activities. There are extensive bottomland forests along both banks inside the Louisiana levee and the Mississippi bluff line. Commercial river traffic is heavy, but there are no docking facilities in this area; the nearest ones upstream are those of the Port of Natchez, Mississippi (mile 362.3). The analysis of bed-material samples taken from the station show a composition of mainly fine and medium sands. Approximate channel gradient in this reach is 0.2 ft/mile. Only instantaneous discharge values are available for the Coochie Discharge Range, and these are referenced to gage reading at the staff gage at Knox Landing, Louisiana (mile 313.7). Daily discharge values are obtained from the

Natchez, Mississippi, gage at mile 362.3 (wire-weight gage). The mean annual discharge at Natchez from October 1951 to September 1974 was 569,000 cfs. A maximum discharge of 2,046,000 cfs was observed on 19 Febraury 1937. A minimum discharge of 99,900 cfs was observed on 3 September 1936. The sediment loads of record (1962 through April 1973 and December 1975 to the present) are: maximum - 3,422,000 tons/day; mean - 592,000 tons/day; and minimum - 53,000 tons/day.

Station chronological record

This station was established in 1962 to monitor sediment loads in the Mississippi River upstream from the Old River Outflow Channel. It was closed in April 1973 and reestablished in December 1975. Sample collection, data reduction, and data publication are the responsibility of the NOD. The laboratory analysis was handled by the NOD from 1962 through April 1973 and by the USGS Louisiana District since December 1975.

Sample and data collection procedures

Twice monthly stream velocity is measured at the Coochie Discharge Range with either a Price or a Gurley current meter to compute instantaneous discharge. After stream velocities are measured, point-integrated, suspended-sediment samples are taken on three verticals at 10, 25, 50, 75, and 90 percent of the depth of the verticals. The positions of these three verticals are determined by the NOD guidelines prepared for the field team. These positions are discharge-weighted. Measurements are made from a boat; prior to December 1975, a US P-46 sampler was used, and since that date, a US P-61 has been used. Bed-material samples are taken at each vertical with a drag bucket.

The field party reads the staff gage at Knox Landing, Louisiana, (mile [illegible]13.7) each time the velocity measurements and samples are taken. S[illegible] re are no discharge rating curves for Knox Landing or Coochie, t[illegible] e readings obtained at the Natchez, Mississippi, gage (mile [illegible] to compute daily suspended-sediment loads.

[illegible] analysis

[illegible] identical to that presented for the Atchafalaya Riv[illegible] ample collection station at Simmesport, Louisiana.

Data reduction procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana, except that daily discharge values from the Natchez gage (mile 362.34) are used as input to the computer programs.

Data publication procedures

Sediment data have never been published in any form, but NOD has provided a sample printout from its records (Figure A59). No table relating the daily interpolated sediment loads and the daily discharge values computed from the Natchez gage is available. Daily discharge values for the Natchez gage are published in Reference 26. Only gage heights are available for the Knox Landing gage, and these are published in Reference 24.

General information

Further information regarding this station can be obtained from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, Louisiana 70160.

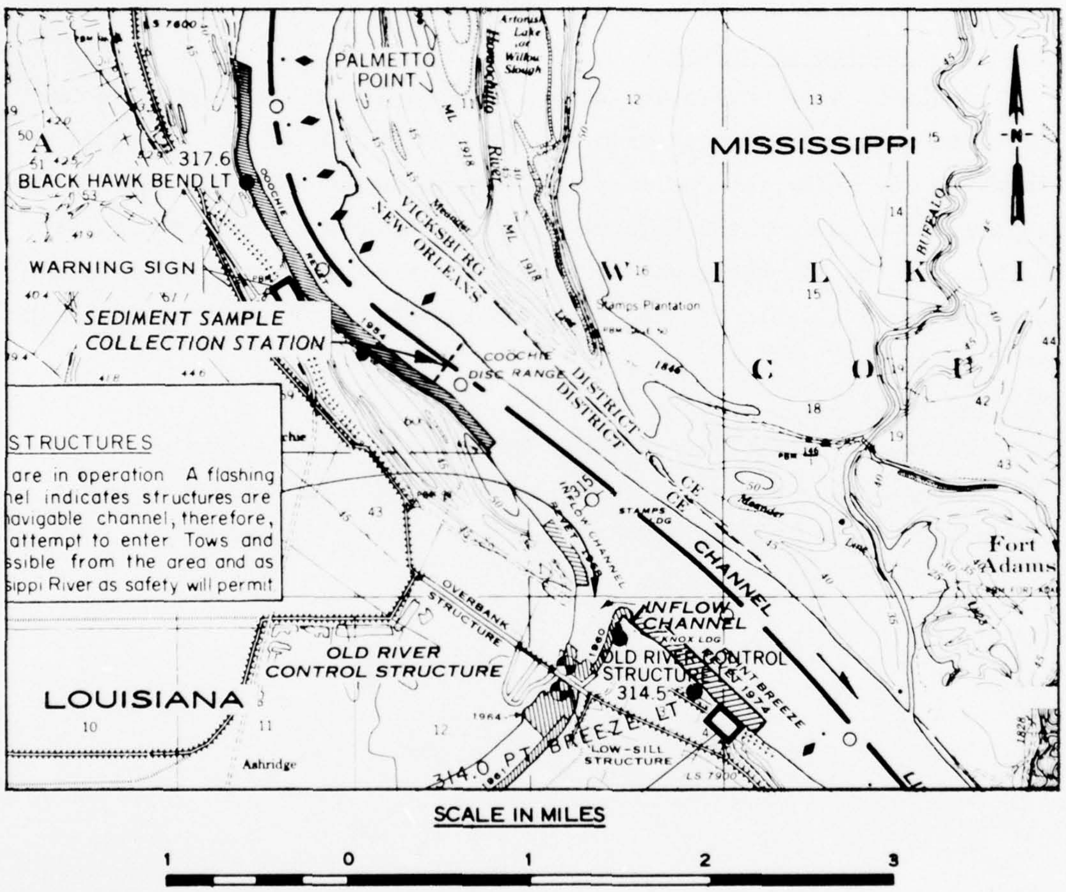


Figure A58. Site location for sediment sample collection station near Coochie, Louisiana (Source: Map No. 41, Flood Control and Navigation Maps of the Mississippi River, Mississippi River Commission, Vicksburg, Mississippi, 1973)

MISSISSIPPI RIVER AT COOCHIE
SUSPENDED SEDIMENT OBSERVATIONS

DATE MO DA YR	Q 1000 CFS	P.P.M. TOT	P.P.M. SAND	P.P.M. SILT	1000 TONS/DAY TOTAL	1000 TONS/DAY SAND	1000 TONS/DAY SILT
10/ 8/71	295,000	186.	17.	169.	147.964	13,524	134,440
10/22/71	229,000	132.	6.	126.	81,514	3,705	77,809
11/ 8/71	295,000	183.	16.	167.	145,578	12,728	132,849
12/22/71	855,000	615.	90.	525.	1417,955	207,506	1210,450
1/ 7/72	627,000	355.	31.	324.	600.229	52,414	547,815
2/22/72	467,000	240.	77.	163.	302,238	96,968	205,270
3/24/72	888,000	345.	115.	230.	826.140	275,380	550,760
4/ 7/72	818,000	300.	93.	207.	661,753	205,143	456,610
4/21/72	767,000	317.	93.	224.	672,753	197,369	475,384
5/25/72	1012,000	364.	121.	243.	993,352	330,208	663,144
6/ 8/72	469,000	241.	18.	223.	304,797	22,765	282,032
6/23/72	380,000	277.	24.	253.	283,847	24,593	259,254
7/21/72	452,000	325.	51.	274.	396,135	62,163	333,972
8/ 4/72	426,000	163.	16.	147.	187,249	18,380	168,868
8/18/72	480,000	262.	43.	219.	339.128	55,658	283,470
9/15/72	314,000	179.	11.	168.	151,567	9,314	142,253
9/29/72	415,000	323.	26.	297.	361,470	29,097	332,373
10/13/72	477,000	278.	37.	241.	357,589	47,593	309,996
11/10/72	740,000	534.	93.	441.	1065,600	185,582	880,018
3/ 9/73	783,000	201.	42.	159.	424,404	88,681	335,722

Figure A59. Example of sediment data for station near Coochie, Louisiana (printout provided by U. S. Army Engineer District, New Orleans)

Mississippi River at Natchez, Mississippi

Station identification

OWDC No.: None

Agency station No.: None, only name is used by agency

Latitude/longitude: 313251/912544

Agency reporting to OWDC: CE

River mile: 362.34 (Mile 0 is at the Head of Passes near the mouth of the Mississippi River; established by the CE in 1962.)

Site description

This station is 0.8 mile downstream from the U. S. Highway 84 Bridge joining Natchez, Mississippi, and Vidalia, Louisiana (Figure A60), in a narrow, straight reach of the river with high top banks. The river channel is adjacent to the limestone bluff (left, or Mississippi bank) at Natchez. An artificial levee parallels the right (or Louisiana) bank. Articulated concrete matting protects a portion of the left bank mainly along the Natchez water front. Inside the levee and bluffs are part of the Natchez-Vidalia industrial areas (lumber mills, concrete casting plant, and other minor industries) as well as bottomland forests. The streambed material consists of sands, and the approximate channel gradient is 0.4 ft/mile. The mean annual discharge from October 1951 to September 1974 was 569,000 cfs. A maximum discharge of 2,046,000 cfs was observed on 19 February 1937, and a minimum of 99,900 cfs on 3 September 1936. Estimated sediment loads during the period of record (1972 to present) are: maximum - 1,917,000 tons/day; mean - 642,000 tons/day; and minimum - 69,000 tons/day.

Station chronological record

This station was established in 1972 at the Natchez Discharge Range, 0.8 mile downstream from the U. S. Highway 84 Bridge (stage records since 1871; intermittent discharge records for 1858-1936, and daily discharge records 1936-1948, and 1950 to the present). The CE Vicksburg District (VXD) is responsible for sample collection, sample laboratory analysis, data reduction, and data publication.

Sample and data
collection procedures

Suspended-sediment and bed-material samples were collected monthly by the VXD personnel through April 1972. Since May 1972, the VXD employees have collected these samples weekly.

Point samples are taken using a 100-lb US P-61 sampler (described in Reference 1a) at sampling verticals located at centroids of equal portions of flow as defined by streamflow measurements. Six verticals are sampled across each range, and four point samples are taken on each vertical at centroids of equal quarters of flow. These centroids are located at 10.7, 32.3, 57.0, and 84.0 percent of the total depth. The sampler is operated from a boat from which it is suspended by cable, reel, and crane.

Bed-material samples are collected at each of the six sampling verticals using the 100-lb US BM-54 sampler (described in Reference 1a).

River stage has been measured daily since 1941 by a paid observer who reads a manually operated wire-weight gage mounted on the U. S. Highway 84 Bridge. From 15 December 1871 to 1941, a staff gage at the foot of Silver Street (mile 363.6) was used. The discharges are computed using the rating curves developed for the discharge range.

Laboratory sample analysis

Sediment samples are analyzed by the Soils Laboratory Section of the VXD. Figure A61 is a sample laboratory sheet (LMK Form 130) used for computation of dissolved solids, total sediment, and sand concentration. Procedures for both suspended/dissolved-sediment analysis and bed-material grain-size analysis are given below:

a. Suspended/dissolved-sediment analysis. With the paper cap removed from the sample bottle, the weight of the bottle and entire sample is recorded to the nearest 0.1 g (line 1), and the total weight of the sample is determined to the nearest 0.1 g (line 3) by subtracting the tare weight.

   (1) Dissolved solids. Approximately 100 g of clear water from the upper portion of sample is placed in a 100-ml beaker, and the weight is recorded to the nearest 0.1 g (line 8). The solution is dried in an oven at 100°C. The weight of solids in solution is recorded to the nearest 0.0001 g. The weight of dissolved solids per g of solution to the nearest 0.000001 g is computed (line 11).

(2) Total sediment. The clear water is removed and wasted from the original sample bottle without removing or disturbing the sediment in the bottom of the bottle. The weight of sediment and remaining water is recorded to the nearest 0.1 g (line 5). The sediment and remaining water is then washed, with distilled water, from bottle into a 100-ml beaker and dried on an oven at 100°C. The total dry weight of sediment and dissolved solids is recorded to the nearest o.0001 g (line 14). The weight of sediment is corrected for the dissolved solids in the water (line 16). Parts per million (ppm) total sediment is then computed (line 17).

(3) Sands and fine concentration. The dried sediment is washed over a U. S. No. 230 sieve. The material on the sieve is then washed into a beaker and oven-dried at 110°C to determine the weight of sand in the sample to the nearest 0.0001 g (line 19). The ppm of sand is computed (line 20). The ppm of the -230 sieve size is computed (line 21) for one sample in each sampling vertical. When only the ppm of sand is required, the initial weighing is the same as above (line 1).

b. Bed-material particle-size analysis. The entire sample is removed from the sample bottle and dried in an oven at 110°C. After the sample has cooled, any aggregation of particles is broken up with a wooden pestle. A representative sample is obtained by dividing, using a sample splitter. The size of the sample to be sieved depends on the maximum particle size. The sample is limited in weight so that no sieve in the series is overloaded. The particle sizes are separated by placing the sample in a nest of U. S. Standard sieves with decreasing opening, top to bottom, on a typical commercially available mechanical sieve shaker and shaken for 10 min with a cover plate on the top and a pan on the bottom: Sieve sizes in the nest are: 3/4 in., 3/8 in., and U. S. Nos. 4, 8, 16,, 20, 30, 40, 50, 70, 100, 140, and 200. The material retained on each sieve is weight to the nearest 0.1 g and recorded on LMK Form 129 (Figure A62).

Data reduction procedures

The Potamology Section, VXD, has the responsibility for data reduction. The following field and laboratory data are entered on computer coding sheets:

a. Discharge. Location, date, air and water temperatures, water-surface elevation, and for each station on the cross section, depth and velocity.

b. Suspended sediments. Location, date, air and water temperatures, and for each vertical at the sampling station, sample depth and

point-sample concentrations of sand and fines.

c. Bed-material samples. Location, date, air and water temperatures, and for each vertical at the sampling station, weight of material passing and weight of material retained on each sieve.

These data are then processed using a computer program that calculates sediment load and provides a printed output.

The data reduction program determines the suspended-sediment load passing the station by the following equation:

$$SL = \frac{SS \times Q}{371}$$

where

SL = suspended-sediment load passing station in tons/day.

SS = suspended-sediment concentration (ppm by weight).

Q = water discharge (cfs).

Data reporting procedures

No sediment data have ever been published for this station, but these data will be published some time during 1976. Figure A63 is a tabulation of sediment and discharge data for the water year 1973-74 provided by the VXD. Discharge data are published in Reference 26.

General information

Sediment data collected through 1974 will be published some time during 1976. The VXD plans to install the necessary instrumentation to monitor river stage and meteorological parameters and to transmit these data via satellite to a ground station at Vicksburg.

Addition information on this station can be obtained from: U. S. Army Engineer District, Vicksburg, Potamology Section, Vicksburg, Miss. 39180.

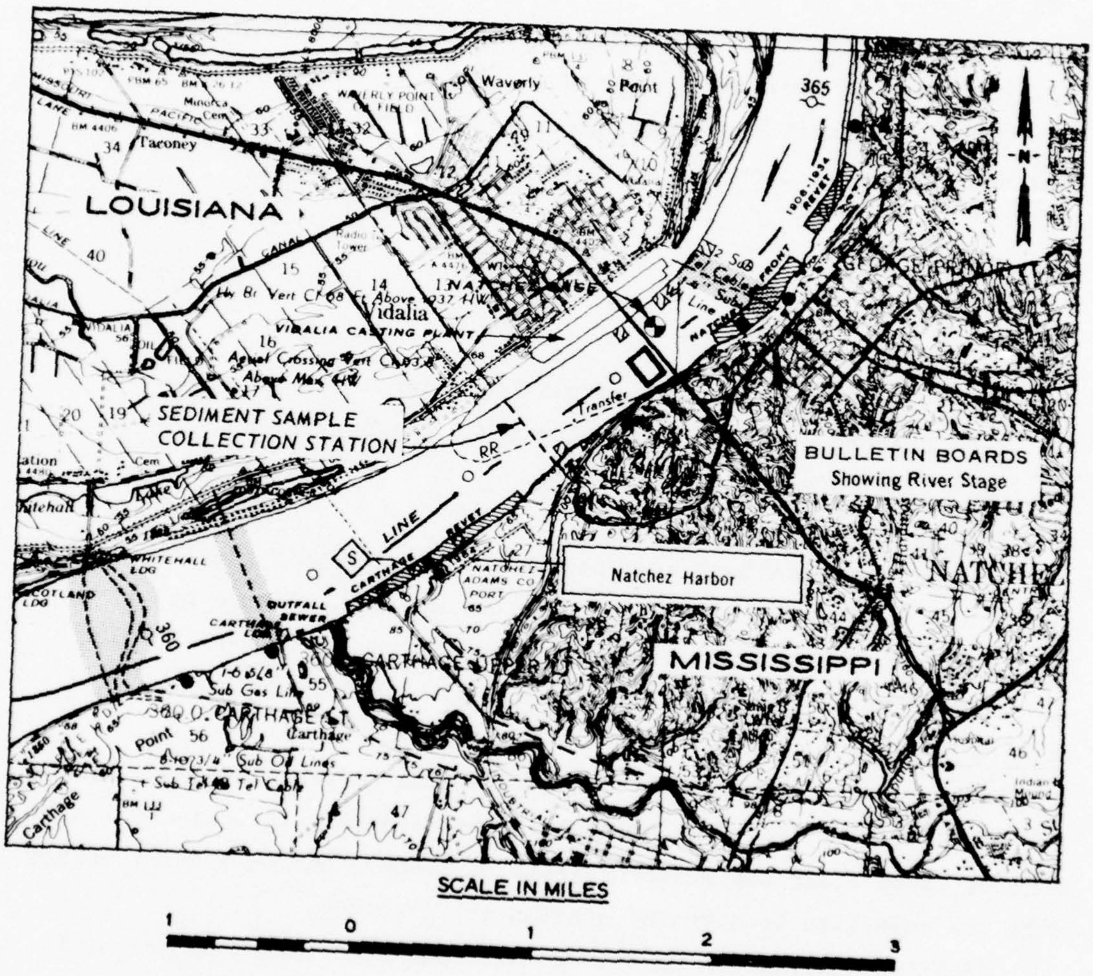


Figure A60. Site location for Natchez, Mississippi, sedi-sample collection station (Source: Map No. 38, Flood Control and Navigation Maps of the Mississippi River, Mississippi River Commission, Vicksburg, Mississippi, 1973)

SEDIMENT ANALYSIS

Stream	Location	Station
Mississippi River	565.9	Natchez, Miss.

Date of Observation	Date of Analysis
28 OCT 1975	30 OCT 1975

	Sample No.	1	2	3	4
1.	Total Wt. Bottle + Sample	622.9			
2A.	Wt. Bottle	373.0			
3.	Total Wt. Sample (1-2A)	249.9			
4.	Wet Wt. Sed. + Bottle	394.5			
2B.	Wt. Bottle	373.0			
5.	Wt. Sed. (4-2B)	21.5			
	Dissolve Solids (D.S.)				
	Beaker No.	407			
6.	Wet Wt. Sample + Beaker	148.9			
7A.	Wt. Beaker (0.0)	49.3			
8.	Wet Wt. Sample (6-7A)	99.6			
9.	Dry Wt. Sample + Beaker	49.3300			
7B.	Wt. Beaker (0.0000)	49.3072			
10.	Dry Wt. Sample (9-7B)	.0228			
11.	Wt. D. S./Gm. in Solution $\left(\frac{10}{8}\right)$	.000229	.000	.000	.000
	Total Sediment				
	Beaker No.	24			
12.	Dry Wt. Sed.& D. S. + Beaker	51.5842			
13A.	Wt. Beaker	51.5265			
14.	Total Sed.& D. S. (12-13A)	.0577			
15.	Correction for D. S. (11 x 5)	.0049			
16.	Wt. Total Sed. (14-15)	.0528			
17.	PPM Sed. $\left(\frac{16}{3}\right)$ (1,000,000)	211			
	Sand Concentration				
18.	Dry Wt. Sand + Beaker	51.5501			
13B.	Wt. Beaker	51.5265			
19.	Dry Wt. Sand (18-13B)	.0236			
20.	PPM Sand $\left(\frac{19}{3}\right)$ (1,000,000)	94			
21.	PPM - 230 (17-20)	117			

LMK Form 130
1 Aug 73

Previous editions of this form are obsolete.

Figure A61. Sediment analysis data form (LMK Form 130) with sample data

SCREEN ANALYSIS

Soils Laboratory, U. S. Army Engineer District, Vicksburg

Date 30 Oct 1975

Damsite Mississippi River | Station A-2400

Location Natchez, Miss. | Depth

Dish No. M-4 | Total Weight of Sample 170.5 Grams

Tyler Sieve No.	U.S. Std. Sieve No.	Opening in Inches	Opening in mm.	Weight Retained	Percent Retained	Percent Finer
1-1/2"		1.5	38.1			
3/4"		0.75	19.05			
3/8"		0.375	9.525	11.6		93.2
# 4	# 4	0.185	4.699	3.2		91.3
# 8	# 8	0.093	2.362	3.0		89.5
#14	#16	0.046	1.168	13.6		81.5
#20	#20	0.0328	0.833	13.0		73.8
#28	#30	0.0232	0.589	14.3		65.3
#35	#40	0.0164	0.417	10.4		59.2
#48	#50	0.0116	0.295	18.5		48.3
#65	#70	0.0082	0.208	64.8		10.0
#100	#100	0.0058	0.147	12.2		2.8
#150	#140	0.0041	0.104	4.2		0.4
#200	#200	0.0029	0.074	0.5		0.1
Pan				0.1		0

Remarks: 169.4

LMK Form 129
17 Jul 62 (Rev)

Figure A62. Screen analysis form (LMK 129) used for analyses of bed-material samples

Date		Streamflow 1000 cfs	Average Velocity fps	Average Depth ft	Width ft	Water Surface Slope 10^{-4} ft/ft	Water Temperature °F	Measured Suspended Sediment: Fines Yield* 1000 tons/day	Total Yield 1000 tons/day	Weighted Mean Concentration, ppm: Fines*	Total	Ratio of Fines/Total
1973												
November	9	496	3.52	48.6	2900		59	303	385	227	288	0.79
	21	382	3.03	44.2	2850		56	133	165	129	160	0.81
	29	615	4.13	51.0	2920		58	980	1184	591	714	0.83
December	5	946	5.23	61.8	2930		54	966	1249	379	490	0.77
	15	1191	6.05	66.3	2970		48	770	1917	240	597	0.40
	20	1131	5.95	64.0	2970		44	497	540	162	177	0.92
	27	879	4.88	60.8	2960		43	483	723	204	305	0.67
1974												
January	9	1156	5.90	65.8	2980		40	505	657	162	211	0.77
	17	1261	6.21	69.5	2920		39	476	547	140	161	0.87
	24	1310	6.24	70.7	2970		47	441	879	125	249	0.50
	31	1418	6.69	71.1	2980		48	661	1494	173	391	0.44
February	7	1485	6.78	73.2	2990		48	600	1745	150	436	0.34
	21	1335	5.86	76.5	2980		47	374	651	104	181	0.57
	28	1136	5.31	72.1	2970		46	367	799	120	261	0.46
March	7	1070	5.32	69.0	2970		50	332	599	130	204	0.62
	14	933	4.66	67.6	2960		55	375	604	149	240	0.62
	21	1079	5.32	68.4	2970		54	532	896	183	308	0.59
	28	1199	5.71	70.7	2970		51	478	1160	148	359	0.41
April	4	1168	5.62	69.8	2980		55	312	667	99	212	0.47
	11	1028	5.17	67.2	2960		57	599	823	216	297	0.73
	18	1086	5.38	68.0	2970		58	442	623	151	213	0.71
	25	1101	5.48	67.7	2970		61	516	736	174	248	0.70
May	2	939	5.12	65.4	2950		65	445	557	167	209	0.80
	9	816	4.51	61.8	2930		68	550	649	250	295	0.85
	16	774	4.23	62.9	2910		69	469	503	225	241	0.93
June	6	1019	5.34	64.5	2960		74	838	1035	305	377	0.81
	20	1298	6.09	71.5	2980		75	644	920	184	263	0.70
	27	1180	5.57	71.1	2980		74	604	906	190	285	0.67
July	3	958	4.86	66.8	2950		76	555	661	215	256	0.84
	11	845	4.59	63.0	2920		89	524	638	230	280	0.82
	18	626	3.82	56.7	2890		83	574	645	340	382	0.89
	25	447	3.13	50.5	2830		84	381	423	316	351	0.90
	31	387	2.87	48.4	2790		82	250	266	240	255	0.94
August	8	341	2.66	46.0	2780		82	157	178	171	194	0.88
	21	419	3.08	48.2	2820		81	159	192	141	170	0.83
	28	364	2.84	45.7	2800		82	87	100	89	102	0.87
September	4	381	2.93	46.6	2790		75	146	164	142	160	0.89
	11	567	3.73	53.1	2860		75	264	339	173	222	0.78
	25	502	3.44	51.2	2850		72	137	180	101	133	0.76
Water Year 1973-74	Avg	861	4.66	60.6	2921		63	461	681	209	287	0.74
	Max	1435	6.78	76.5	2990		89	980	1917	591	714	0.95
	Min	304	2.53	42.4	2780		39	87	100	89	102	0.34

* Fines - material finer than 0.062 mm (diameter). Source: Robbins, L. G., "Suspended Sediment and Bed Material Studies on the Lower Mississippi River, Vicksburg District (in preparation), U. S. Army Engineer District, Vicksburg, Vicksburg, Miss.

Figure A63. Summary of suspended-sediment measurements, Mississippi River, for Natchez sediment sample collection station, water year 1973-74.

Mississippi River at Vicksburg, Mississippi

Station identification

OWDC No.: CE, None; USGS, 85494

Agency station No.: CE, None; USGS, 072890000

Latitude/longitude: 321827/905421

Agencies reporting to OWDC: CE, USGS

River mile: 435.41 (Mile 0 is at the Head of Passes near the mouth of the Mississippi River; established by the CE in 1962.)

Site description

This station is at the downstream end of the river bend at the Vicksburg, Mississippi, Discharge Range and 0.4 mile downstream from the Interstate 20 Bridge joining Vicksburg and Delta, Louisiana, 1.6 miles below the present Vicksburg gage, and 2 miles downstream from the mouth of the Yazoo Diversion Canal (Figure A64). Along this reach, the Mississippi River flows along the eastern edge of its floodplain against limestone bluffs that extend into the bed of the river. Artificial levees parallel the right (or Louisiana) bank, and articulated concrete matting protects portions of both banks upstream from the sediment station. The urban-industrial area of Vicksburg extends upstream and downstream for approximately 3 miles. The Port of Vicksburg is 5 miles upstream from the mouth of the Yazoo Diversion Canal. There are three utility crossings within 2 miles upstream, and the Vicksburg railroad and highway bridge (Illinois Central-Gulf Railroad - U. S. Highway 80) is 0.5 mile upstream. Limestone bedrock is exposed in the channel near the left bank, and the bed material collected in the trough and between the trough and right bank consists of sands with minor amounts of gravel. Channel gradient in this reach of the river is 0.4 ft/mile. The mean annual discharge from October 1929 to September 1972 was 569,000 cfs. Maximum would have been approximately 2,278,000 cfs for the May 1927 flood, if flow had been confined between levees. The minimum was 93,800 cfs, observed on 31 August 1936. The estimated sediment loads during the period of record (1968 to the present) are:

maximum - 2,865,000 tons/day; mean - 695,000 tons/day; and minimum - 66,000 tons/day. These figures are based on the records of the CE station.

Station chronological record

The station was established in 1968 by the CE Vicksburg District (VXD) at a discharge range and near established gaging stations on both the Mississippi River and Yazoo Diversion Canal. The purpose of the sediment station was to monitor sediment loads in this reach of the Mississippi River. In October 1973, the USGS Mississippi District established a monthly water-quality monitoring station at Vicksburg (mile 430.4) as part of the National Stream Quality Accounting Network (NASQUAN). The VXD and the USGS Mississippi District are each responsible for sample collection, laboratory analysis, data reduction, and data publication; these are completely separate operations.

Sample and data collection procedures

Information regarding the collection of sediment samples by the VXD and river stage data with the staff gage is identical to that presented for the Mississippi River sediment sample collection station at Natchez, Mississippi. As part of the NASQUAN program, the USGS personnel collect four depth-integrated (descending trip only) water-quality (chemical constituents and suspended-sediment concentrations) samples on a single vertical at the thalweg of the river using the following increments: 0-25, 25-50, 50-75, and 75 ft to maximum depth; a US P-61 sampler is used (Reference 1a).

Daily temperatures are measured for the USGS by a paid observer.

Gaging records in the vicinity of Vicksburg date back to 1828. Instantaneous discharge was measured in 1858 and has been measured intermittently from 1884 to the present by both the VXD and the USGS. The daily discharge has been computed based on gage-height readings and the rating curve for this reach since 1928 by VXD and since 1931 by the USGS. Various locations on the Mississippi River and its abandoned channel (what is now the Yazoo Diversion Canal) were used; even though the Mississippi River changed its course in 1876 (Centennial Cutoff) abandoning DeSoto Island, Louisiana, the gages located in the old

channel ("canal gages") were used. A tabulation of the gaging and recording devices used in the vicinity of Vicksburg during the period of record, as well as the gaging localities and the agencies responsible for collecting these data is presented below:

Period	Locality	Device Used
	U. S. Signal Corps and later U. S. Weather Bureau (now National Weather Service)	
1828 - 1871 (intermittent readings)	Kleinston, Mississippi (mile 436.6)	Staff gage
10 September 1871 - 30 November 1922	(a) Foot of South Street (1.1 miles upstream from mouth of Yazoo Diversion Canal); (b) foot of Fairground Street (0.3 mile upstream from mouth of Yazoo Diversion Canal; (c) Delta, Louisiana (mile 435.9?); (d) Kleinston, Mississippi (mile 436.6)	Staff gages
1 December 1922 - 31 August 1934	Foot of Fairground Street (0.3 mile upstream from mouth of Yazoo Diversion Canal) (Canal gage)	Inclined staff gage
1 September 1934 - present	Vicksburg railroad and highway bridge (mile 435.8)	Wire-weight gage (VXD gage used after 1949)
1967 - June 1969	100 ft downstream from Vicksburg railroad and highway bridge (left bank) (mile 435.8)	Telepulse gage
June 1969 - present	0.3 mile downstream from mouth of Yazoo Diversion Canal (mile 437.0)	Telemark gage (VXD property)

Period	Locality	Device Used
	VXD	
10 September 1871 - 30 November 1922	(a) Foot of South Street (1.1 miles upstream from mouth of Yazoo Diversion Canal); (b) foot of Fairground Street (0.3 mile upstream from mouth of Yazoo Diversion Canal); (c) Delta, Louisiana (mile 435.9?); (d) Kleinston, Mississippi (mile 436.6)	Staff gages
1 December 1922 - present	Foot of Fairground Street (0.3 mile upstream from mouth of Yazoo Diversion Canal) (Canal gage)	Inclined staff gage
1 September 1934 - 31 December 1962	Vicksburg railroad and highway bridge (mile 435.8)	Wire-weight gage (Weather Bureau gage used prior to 1949)
1 January 1963 - 31 December 1967	Vicksburg railroad and highway bridge (mile 435.8)	Stevens A-35 water-stage recorder driven by manometer
1 January 1968 - present	0.3 mile downstream from mouth of Yazoo Diversion Canal (mile 437.0)	Stevens A-35 water-stage recorder driven by manometer
1 January 1968 - present	0.3 mile downstream from mouth of Yazoo Diversion Canal (mile 437.0)	Vertical staff gage
June 1969 - present	0.3 mile downstream from mouth of Yazoo Diversion Canal (mile 437.0)	Stevens telemark gage driven by manometer
	USGS	
1930 - 1932	Mile 434.8	Staff gage

(Continued)

Period	Locality	Device Used
	USGS (Continued)	
19 March 1930 - present	Vicksburg railroad and highway bridge (mile 435.8)	Au continuous recorder Model C-S-B-T No. 711-30 driven by float; later replaced by Stevens A-35 water-stage recorder driven by manometer

In April 1976, the VXD installed a satellite platform beneath the Interstate 20 Bridge (mile 435.8). This unit, when operational, will transmit river stage as well as meteorological data from yet a new location for the Vicksburg gage downstream from the two bridges.

Laboratory sample analysis

Information regarding the processing of the CE samples is identical to that presented for the Mississippi River sediment sample collection station at Natchez, Mississippi. The USGS samples are analyzed for concentrations by the laboratory of the USGS Louisiana District, Baton Rouge, Louisiana. Concentrations of individual samples are mathematically composited; Reference 1b contains a description of the procedures used.

Data reduction procedures

Information regarding the reduction of the CE data is identical to that presented for the Mississippi River sediment sample collection station at Natchez, Mississippi. The USGS sediment data are reduced using Water Resources Division computer programs; Reference 1c discusses these procedures.

Data reporting procedures

Sediment data have not yet been published in any form, but the computer printouts of reduced data have been used for the various VXD in-house studies of alluvial river hydraulics. Figure A65 is a tabulation of sediment and discharge data for water year 1974 provided by the VXD. Discharge data from the Arkansas City gaging station are published in Reference 26. These data were also published in Reference 12 prior

to water year 1966 and from water year 1966 to the present in Reference 27.

Sediment data collected through 1974 will be published some time during 1976.

Monthly USGS water-quality data (including sediment loads) are published annually in Reference 28. Discharge data from the Vicksburg gaging station are published annually in Reference 26; these data were also published in Reference 12 prior to water year 1966 and since 1961 in References 25 and 29. The USGS enters daily discharge and temperature in its WATSTORE files, and the results of the chemical and sediment analyses in its Water Resources Division water-quality files. All of these values are transferred periodically to the Environmental Protection Agency's STORET System.

General information

Gaging records at Vicksburg are regarded as excellent since sufficient discharge measurements are made to determine daily discharge by the hydrograph for this station with a great degree of confidence.

Additional information on this station can be obtained from: U. S. Army Engineer District, Vicksburg, Potamology Section, Vicksburg, Mississippi 39180; or U. S. Department of the Interior, Geological Survey, Water Resources Division, 430 Bounds Street, Jackson, Mississippi 39206.

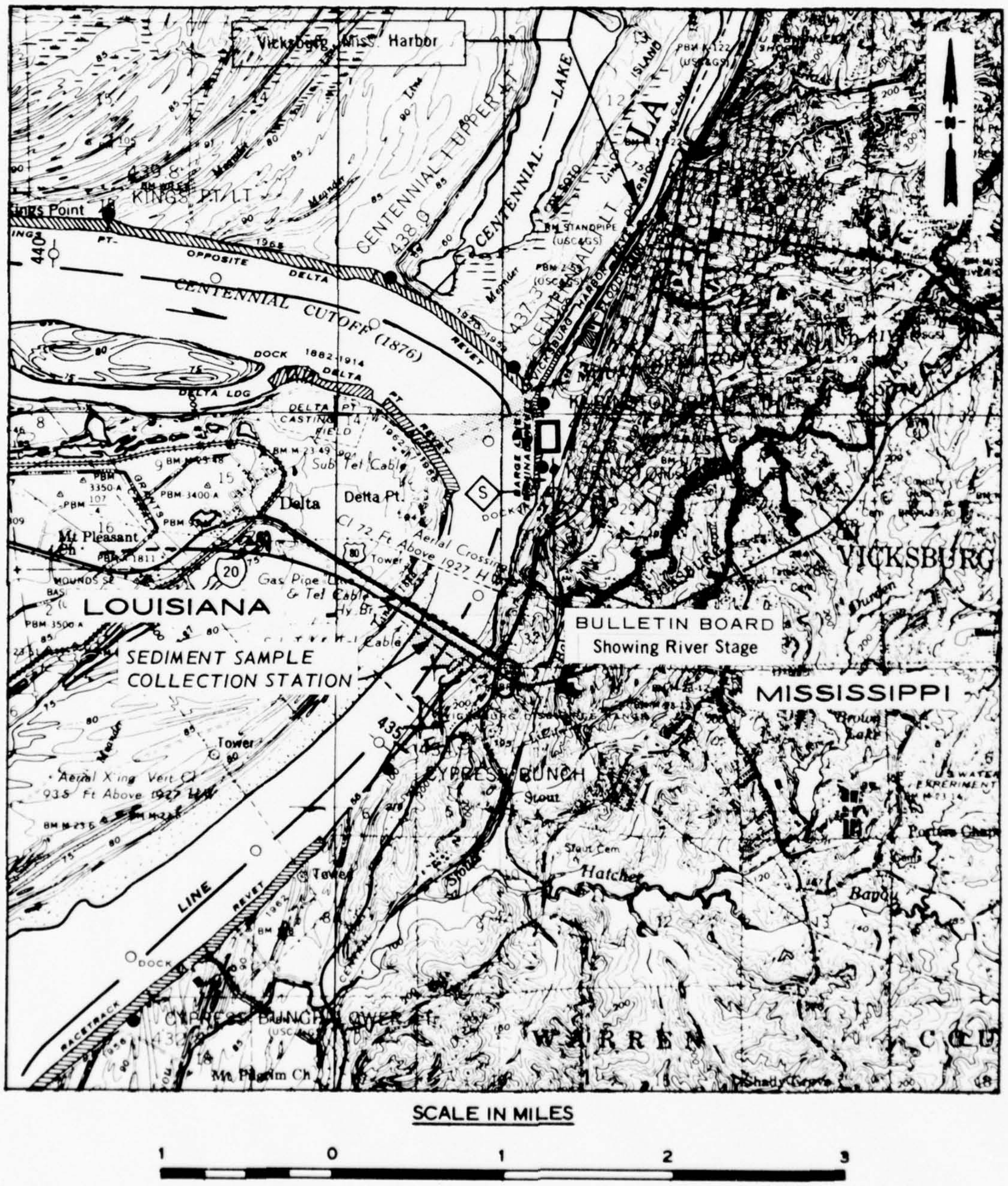


Figure A64. Site location for Vicksburg, Mississippi, sediment sample collection station (Source: Map No. 33, Flood Control and Navigation Maps of the Mississippi River, Mississippi River Commission, Vicksburg, Mississippi, 1973)

Date		Streamflow 1000 cfs	Average Velocity fps	Average Depth ft	Width ft	Water Surface Slope 10^{-4} ft/ft	Water Temperature °F	Measured Suspended Sediment: Fines Yield* 1000 tons/day	Total Yield 1000 tons/day	Weighted Mean Concentration, ppm: Fines*	Weighted Mean Concentration, ppm: Total	Ratio of Fines/Total
1973												
October	1	312	3.19	46.3	2110		75	93	103	110	123	0.89
	9	555	4.70	47.0	2510		73	657	754	439	504	0.87
	15	609	4.80	47.0	2700		70	658	773	401	471	0.85
	23	611	4.81	47.4	2680		67	568	677	345	411	0.84
	29	583	4.86	44.8	2680		66	558	677	355	431	0.82
November	5	501	4.47	45.7	2450		61	316	331	234	282	0.83
	12	517	4.34	48.0	2480		57	209	273	150	196	0.77
	19	422	3.94	45.9	2330		56	125	159	110	140	0.79
	26	460	4.18	46.4	2370		60	187	245	151	198	0.76
December	3	1020	6.54	55.1	2830		56	1116	1471	406	535	0.76
	10	1233	6.97	57.3	3090		50	1130	2729	340	821	0.41
	17	1257	6.98	57.9	3110		46	908	1894	268	559	0.48
	26	813	5.38	54.9	2750		43	388	686	177	313	0.57
1974												
January	7	1112	6.43	58.4	2960		39	665	1439	222	480	0.46
	15	1280	6.74	61.3	3100		37	600	1459	174	423	0.41
	21	1258	6.52	61.5	3140		42	427	451	126	133	0.95
February	4	1437	7.52	60.1	3180		46	620	1495	160	386	0.41
	19	1377	7.25	60.1	3160		48	471	1284	127	346	0.37
	25	1076	6.18	56.3	3090		46	512	1267	180	437	0.41
March	8	1044	6.25	54.6	3060		54	470	898	167	319	0.52
	22	1147	6.95	53.6	3080		54	541	1002	175	324	0.54
	29	1229	7.15	55.5	3100		51	444	1332	134	402	0.33
April	5	1101	6.59	54.0	3090		56	329	733	111	247	0.45
	12	1002	6.26	56.1	2850		57	448	772	166	286	0.58
	15	1015	6.30	55.5	2900		58	506	1135	185	415	0.45
	22	1081	6.67	55.9	2900		60	481	994	165	341	0.48
	29	1032	6.41	55.5	2900		65	517	1021	186	367	0.51
May	6	870	5.88	52.7	2810		67	603	811	257	346	0.74
	13	753	5.54	49.1	2770		68	398	593	196	292	0.67
	20	722	5.51	47.6	2750		72	395	508	203	261	0.78
	28	939	6.30	52.7	2830		73	731	1012	289	400	0.72
June	3	1021	6.46	54.5	2900		73	1200	1522	436	553	0.79
	10	1154	6.83	54.7	3090		74	958	1306	308	420	0.73
	17	1350	7.16	60.8	3100		75	728	1248	200	343	0.58
	28	1118	6.32	57.3	3090		76	684	928	227	308	0.74
July	1	1005	5.88	59.0	2900		76	615	864	227	319	0.71
	8	909	5.79	55.9	2810		78	757	907	309	370	0.84
	15	717	5.05	51.4	2760		82	404	539	209	279	0.75
	22	487	4.12	48.8	2420		86	251	306	191	233	0.82
	29	405	3.68	47.2	2330		84	177	212	162	194	0.84
August	5	351	3.38	45.8	2270		83	105	140	111	148	0.75
	16	353	3.46	45.1	2260		83	75	93	79	98	0.81
	19	415	3.88	45.7	2340		81	139	164	124	147	0.84
	30	346	3.43	44.5	2270		82	80	96	86	103	0.83
September	3	367	3.56	45.4	2270		77	134	157	135	159	0.85
	9	532	4.47	48.8	2440		83	274	369	191	257	0.74
	16	562	4.57	48.6	2530		76	238	367	157	242	0.65
	30	385	3.70	43.9	2370		69	109	142	104	137	0.76
Water Year 1974	Avg	830	5.49	52.1	2748		65	479	730	203	325	0.28
	Max	1437	7.52	61.5	3180		86	1200	2729	439	821	0.95
	Min	312	3.19	43.9	2110		37	75	93	77	98	0.35

* Fines - material finer than 0.062 mm (diameter). Source: Robbins, L. G., "Suspended Sediment and Bed Material Studies on the Lower Mississippi River, Vicksburg District (in preparation), U. S. Army Engineer District, Vicksburg, Vicksburg, Miss.

Figure A65. Summary of suspended-sediment measurements, Mississippi River, for Vicksburg sediment sample collection stations, water year 1974

Mississippi River at Arkansas City, Arkansas

Station identification

OWDC No.: None

Agency station No.: None, only name is used by agency

Latitude/longitude: 333836/911107

Agency reporting to OWDC: CE

River mile: 565.9 (Mile 0 is at the Head of Passes near the mouth of the Mississippi River; established by the CE in 1962.)

Site description

This station is at the Arkansas City, Arkansas, Discharge Range in a narrow, deep reach between two river bends about 2.5 miles upstream from Arkansas City and 11.6 miles upstream from the Arkansas City river gage (Figure A66). The concave banks of the river bends have been stabilized with revetment, and stone dikes have been placed across the point bar chute channels. Artificial levees parallel both banks along this segment of the Mississippi River. Inside the levees on both the left (or Mississippi) and right (or Arkansas) banks are dense bottomland forests. There are no bridge crossings, industrial, urban, or agricultural areas in the vicinity of the sediment sampling station. The mouth of the Arkansas River is 16.1 miles upstream. Streambed materials are sands and gravels, although the amount of gravel has declined gradually due to commercial dredging operations. The channel gradient is approximately 0.4 ft/mile.

The mean annual discharge from October 1929 to September 1974 was 549,000 cfs. The maximum discharge would have been approximately 2,472,000 cfs for the May 1927 flood if the flow had been confined between levees. A discharge of 2,159,000 cfs was observed on 16 February 1937, and a minimum of 88,200 cfs on 31 October 1939. Flows are influenced by locks and dams upstream of the gaging station. Estimated suspended-sediment loads during the period of record (1967 to the present) are: maximum - 2,124,000 tons/day; mean - 587,000 tons/day; and minimum - 51,000 tons/day.

Station chronological record

This station was established in 1967 at an established discharge range and near a gaging station (daily flow records from January 1928 to the present, intermittent records of gage height since 1879, and discharge records since 1884) to monitor sediment loads in this reach of the Mississippi River. The CE Vicksburg District (VXD) is responsible for sample collection, sample laboratory analysis, data reduction, and data publication.

Sample and data collection procedures

Information regarding the collection of sediment samples is identical to that presented for the Mississippi River sediment sample collection station at Natchez, Mississippi.

River stage has been measured with a permanently mounted staff gage since 26 November 1879. The location of this gage has been changed progressively downstream during the period of record and is now 11.6 miles downstream from the sediment collection station. The gage used at Arkansas City has always been a staff gage. Discharges are computed using a rating curve developed for this gaging station. Air and water temperatures are also recorded with the collection of each sediment sample.

Laboratory sample analysis

Information is identical to that presented for the Mississippi River sediment sample collection station at Natchez, Mississippi.

Data reduction procedures

Information is identical to that presented for the Mississippi River sediment sample collection station at Natchez, Mississippi.

Data reporting procedures

Information regarding the publication of the CE sediment data is identical to that presented for the Mississippi River sediment sample collection station at Vicksburg, Mississippi. An example is shown in Figure A67.

General information

Additional information on the station can be obtained from: U. S. Army Engineer District, Vicksburg, Potamology Section, Vicksburg, Mississippi 39180.

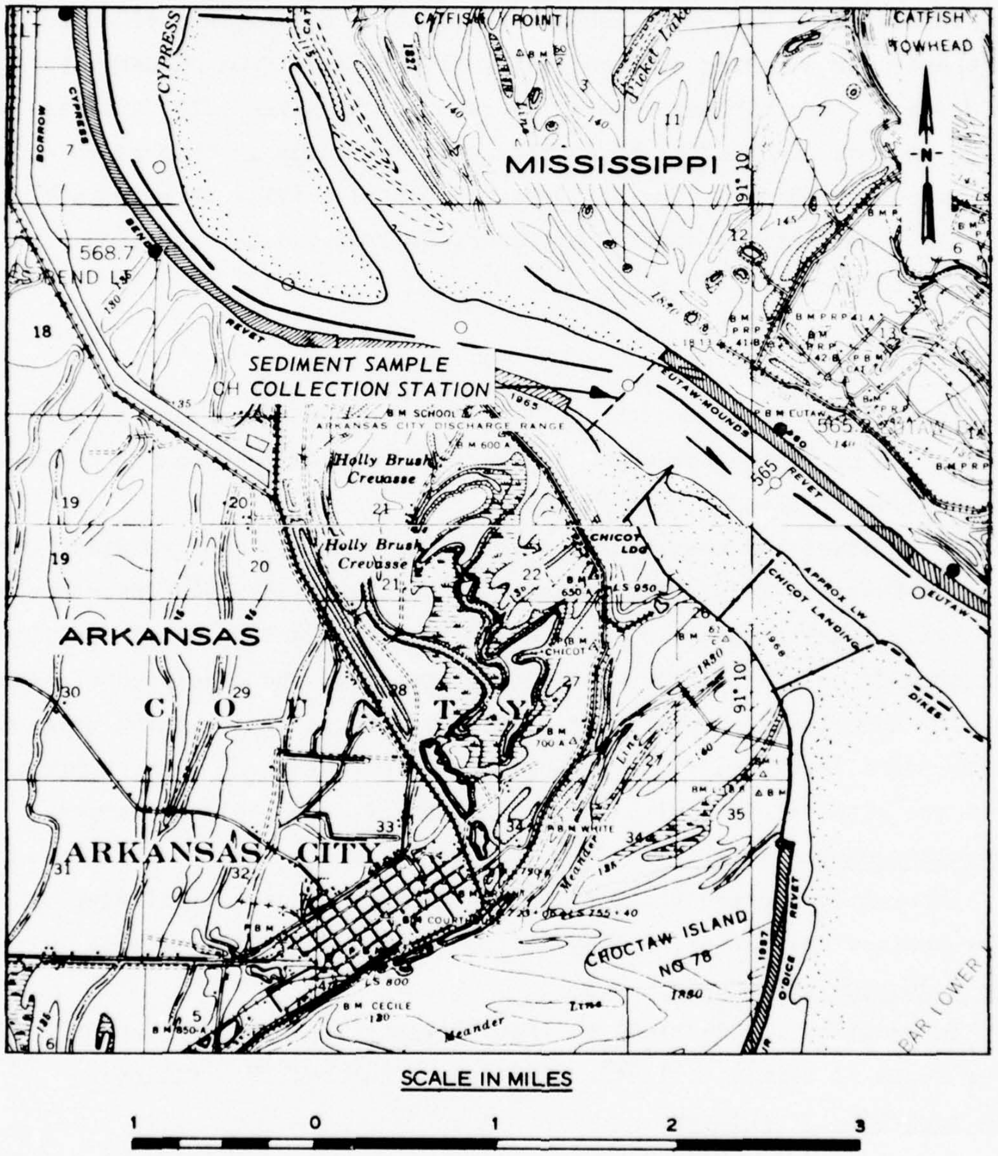


Figure A66. Site location for Arkansas City, Arkansas, sediment sample collection station (Source: Maps Nos. 24 and 25, Flood Control and Navigation Maps of the Mississippi River, Mississippi River Commission, Vicksburg, Mississippi, 1973)

Date		Streamflow 1000 cfs	Average Velocity fps	Average Depth ft	Width ft	Water Surface Slope 10^{-4} ft/ft	Water Temperature °F	Measured Suspended Sediment: Fines Yield* 1000 tons/day	Total Yield 1000 tons/day	Weighted Mean Concentration, ppm: Fines*	Total	Ratio of Fines/Total
1973												
November	5	474	3.46	39.8	3440	0.974	60	317	381	248	298	0.83
	14	412	3.17	45.0	2890	0.955	55	120	152	108	137	0.79
	19	347	2.81	43.2	2860	0.968	55	99	116	106	124	0.85
December	7	1176	5.97	44.4	4440	0.746	52	1322	2124	417	670	0.62
	11	1199	5.91	45.4	4470	0.669	49	905	1839	280	569	0.49
	17	1110	5.80	45.0	4440	0.668	44	722	1313	231	420	0.55
1974												
January	7	1131	5.92	43.3	4410	0.666	38	570	1479	187	485	0.39
	21	1304	6.65	43.9	4460	0.647	44	552	1504	157	428	0.37
	28	1340	6.63	45.0	4490	0.624	46	683	1680	189	465	0.41
February	4	1427	6.80	46.7	4500	0.616	47	731	1650	203	429	0.47
	11	1475	7.11	46.2	4500	0.612	43	692	1757	174	442	0.39
	19	1156	5.88	44.0	4470	0.632	45	380	888	122	285	0.43
March	1	1050	5.47	43.5	4420	0.629	45	594	965	210	341	0.62
	9	852	4.81	49.4	3590	0.599	52	278	439	121	213	0.57
	15	982	5.38	50.8	3600	0.658	54	490	741	[illegible]	280	0.66
	18	1044	5.45	43.3	4430	0.653	54	492	794	[illegible]	[illegible]	0.62
April	5	1016	5.41	42.4	4430	0.634	53	288	553	105	202	0.52
	8	954	5.20	51.0	3600	0.644	53	360	536	140	220	0.64
	15	1013	5.26	43.6	4420	0.639	55	440	781	161	286	0.56
	26	1025	5.26	43.9	4430	0.631	58	481	738	174	267	0.65
	29	942	5.14	50.9	3610	0.647	63	434	614	171	242	0.71
May	6	801	4.65	48.1	3580	0.676	66	538	667	249	309	0.81
	13	725	4.48	52.0	3110	0.847	66	379	520	194	266	0.73
	20	728	4.49	52.1	3110	0.828	69	343	479	175	244	0.72
	28	943	5.28	49.7	3600	0.677	71	1505	1739	592	684	0.87
June	3	1067	5.53	43.4	4440	0.576	71	1265	1596	440	[illegible]55	0.79
	10	1195	5.77	46.4	4470	0.697	71	1018	1047	316	325	0.97
	17	1302	6.08	47.6	4500	0.664	74	786	807	224	230	0.97
	24	1109	5.45	45.5	4470	0.567	74	717	945	240	316	0.76
July	1	845	4.65	50.8	3580	0.642	74	485	617	213	271	0.79
	8	821	4.77	48.2	3570	0.655	77	485	651	219	294	0.74
	15	616	4.03	49.9	3060	0.623	82	367	480	221	289	0.76
	22	427	3.09	47.8	2890	0.734	83	167	190	145	165	0.88
	29	354	2.76	45.2	2840	0.803	84	142	155	149	162	0.92
August	5	306	2.56	42.5	2820	0.788	80	45	56	54	68	0.79
	12	303	2.56	41.8	2830	0.793	80	93	100	114	123	0.93
	19	398	3.16	43.5	2900	0.716	79	121	159	113	148	0.76
	26	334	2.76	42.5	2850	0.687	81	68	78	76	87	0.87
September	6	474	3.59	45.2	2920	0.664	75	216	259	169	202	0.84
	20	463	3.41	46.5	2930	0.648	73	96	141	77	113	0.68
	23	450	3.40	45.3	2920	0.639	70	113	131	93	108	0.86
	30	349	2.86	42.7	2860	0.727	68	79	96	84	102	0.82
Water Year 1974	Avg	810	4.61	45.6	3679	0.725	63	482	744	207	300	0.72
	Max	1475	7.11	52.1	4500	1.110	84	1505	2124	592	684	0.97
	Min	300	2.48	39.8	2820	0.567	38	45	56	54	68	0.37

* Fines - material finer than 0.062 mm (diameter). Source: Robbins, L. G., "Suspended Sediment and Bed Material Studies on the Lower Mississippi River, Vicksburg District (in preparation), U. S. Army Engineer District, Vicksburg, Vicksburg, Miss.

Figure A67. Summary of suspended-sediment measurements, Mississippi River, for Arkansas City sediment sample collection station, water year 1974

Mississippi River at Memphis, Tennessee

Station identification

OWDC No.: 85492

Agency station No.: 07032000

Latitude/longitude: 350500/900415

Agency reporting to OWDC: USGS

River mile: 734.8 (Mile 0 is at the Head of Passes near the mouth of the Mississippi River; established by the CE in 1962.)

Site description

The Mississippi River is sampled at Memphis 50 ft downstream from the Harahan Railroad bridge, which connects Memphis, Tennessee, and West Memphis, Arkansas (Figure A68), in a relatively straight reach of the river with a narrow and somewhat unstable sandy channel. Artificial levees parallel the right (or Arkansas) bank and those portions of the left (or Tennessee) bank below the bluff line. Articulated concrete matting and dikes protect both banks. The entrance to the Memphis harbor (old mouth of the Wolf River) is 1.3 miles upstream from the sediment station. This harbor is lined with numerous commercial and government docks. The present mouth of the Wolf River is 3.5 miles upstream from the sediment station. The industrial and urban areas of Memphis-West Memphis extend upstream for 6.8 miles to the mouth of the Loosahatchie River. Channel gradient in the vicinity of the sampling station is 0.5 ft/mile. The discharges measured during the period of record (1933 to the present) are: maximum - 1,980,000 cfs; mean - 462,100 cfs; and minimum - 19,200 cfs. The estimated daily suspended-sediment loads for the period of record (February 1973 to the present) are: maximum - 690,000 tons/day; mean - 218,000 tons/day; and minimum - 50,000 tons/day. The estimated mean daily dissolved solid load occurring during 1973-1974 was 460,000 tons/day.

Station chronological record

This station was established in February 1973 as part of the USGS National Stream Quality Accounting Network (NASQUAN). The USGS Arkansas

District is responsible for sample collection, data reduction, and data publication. Sample laboratory analysis is the responsibility of the USGS Sedimentation Laboratory in Albuquerque, New Mexico. Gaging data are collected by the CE Memphis District (MD).

Sample and data
collection procedures

Four equally spaced, depth-integrated verticals are sampled monthly by the USGS Arkansas District personnel using a US P-63 sampler. Round quart-size milk bottles (in cavity of sampler) are used to sample from one to three sections along each vertical with an electrically controlled equal-transit rate. The transit rate used is the rate that yields a two-third-quart sample on the section having the highest stream velocity. Separate samples are taken for both the upward and downward transit for each section of each vertical. Temperatures are collected with each sample. The US P-63 sampler and the sampling techniques used are discussed in Reference 1a.

Gaging in the vicinity of Memphis began in November 1871 with a nonrecording gage near Beale Street (mile 736.1). In September 1932, a nonrecording gage was placed at mile 735.0 and remained there until December 1934, when a Stevens A-35 water-stage recorder was put into operation on the Haranan Railroad bridge (mile 734.8), its present position. Since January 1976, the stage has been measured automatically at 15-min intervals with a Stevens 7000 automatic digital recorder, which punches the values onto a paper tape; attached to this recorder is a telemark device, which enables the MD and National Weather Service personnel to obtain river stage readings by dialing a local telephone number. Agencies responsible for collecting river stage data during the period of record have included the USGS, the MD, and the National Weather Service. The MD has had the sole responsibility for reading and maintaining the gage since 1972. Discharge is computed using the rating curve developed for this location.

Laboratory sample analysis

The USGS Sedimentation Laboratory in Albuquerque, New Mexico, is responsible for analysis of the sediment samples. Data on dissolved solids, suspended solids, specific conductance, pH, hardness, chemical

constituents, and biological constituents are reported from the laboratory analyses. Procedures used in these analyses are discussed in Reference 1b.

Data reduction procedures

Sediment concentration and discharge data are used as input to computer programs that calculate sediment load (tons/day). Separate calculations are made for the dissolved-sediment load and for the suspended-sediment load. The procedures used in reduction of these data are presented in Reference 1c.

Data reporting procedures

Sediment, chemical, and biological data are published annually in Reference 2. Data for only two selected days in water year 1974 have been published; the water year 1975 monthly values have not yet been reduced. No examples of these data are available. Sediment data are entered on a regular basis to the USGS Water-Quality Files, which automatically become a part of the Environmental Protection Agency's STORET System and automated information retrieval system. These data will later be added to the USGS WATSTORE System. Discharge data are published annually in References 27, 29, and 30 and are entered in the Daily Values File, a part of WATSTORE, but are not automatically added to STORET.

General information

The MD hopes to relocate its gage on the Memphis-Arkansas (U. S. Highways 61, 70, and 79) Bridge 200 ft downstream from its present position.

Although the number of samples collected at this station since February 1973 are not sufficient to draw any reasonable conclusions about sediment loads in this reach of the Mississippi River, this station is part of the nationwide NASQUAN network and will continue to operate indefinitely. The NASQUAN program is committed to fulfilling the long-term objectives of detection of trends in water quality.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, Room 2301, Federal Office Building, 700 West Capital Avenue, Little Rock, Arkansas 72201.

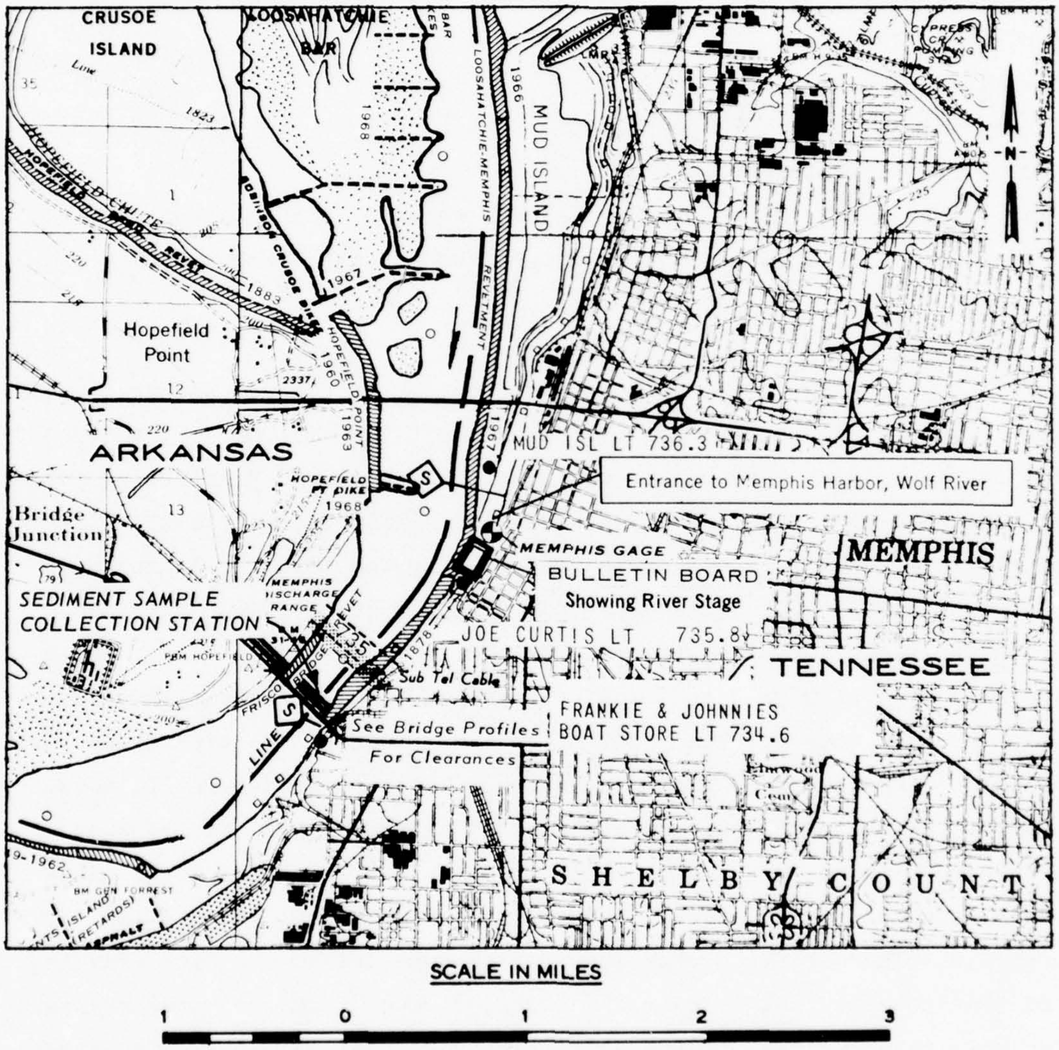


Figure A68. Site location for Memphis, Tennessee, sediment sample collection station (Source: Map No. 14, Flood Control and Navigation Maps of the Lower Mississippi River, Mississippi River Commission, Vicksburg, Mississippi 1973)

Mississippi River at Thebes, Illinois

Station identification

OWDC No.: 74804

Agency station No.: 07022000

Latitude/longitude: 371300/892750

Agency reporting to OWDC: USGS

River mile: 43.7 (Mile 0 is at the confluence of the Ohio and Mississippi rivers; established by the CE in 1930.)

Site description

The gaging and sediment sample collection station at Thebes, Illinois, are on the Thebes railroad bridge (Missouri Pacific Railroad and St. Louis Southwestern Railway), which crosses the Mississippi River at mile 43.7 and links the towns of Thebes, Illinois, and Illmo, Missouri (Figure A69). Upstream is riprap along the left (or Illinois) bank from mile 44.5 to mile 44.9 and from mile 48.1 to mile 51.0 and along the right (or Missouri) bank from mile 50.2 to mile 51.1. There are also several wing dams along both banks. An artificial levee parallels the left bank upstream from mile 45.8. Much of the area along both banks is forested land, including Shawnee National Forest in Illinois. Some of these areas have been cleared and support crops and orchards. Upstream from the Thebes bridge are a number of commercial docks along the right bank for 12 miles. Cape Girardeau, Missouri, is 9 miles upstream. The streambed consists of fine sands with some fine gravels, and limestone bedrock is near the surface. Approximate channel gradient for this reach of the Mississippi River is 0.5 ft/mile. The discharges for the period of record (October 1932 to the present) are: maximum - 893,000 cfs; mean - 187,900 cfs; and minimum - 23,400 cfs. The natural flow of this stream is affected by many reservoirs and navigation dams in the upper Mississippi River Basin and by many reservoirs and diversions for irrigation in the Missouri River Basin. High stages in the Ohio River sometimes cause backwater at Thebes. The four suspended-sediment loads measured during the period of record (October 1974 to the

present) have ranged from 25,700 tons/day to 61,900 tons/day. No mean load has been computed for these four values because they were not evenly distributed throughout the year.

Station chronological record

The USGS established the sediment sample collection program at Thebes in October 1974 as a part of the National Stream Quality Accounting Network (NASQUAN). Its purpose is to monitor sediment loads in the Mississippi River upstream from the confluence of the Ohio and Mississippi rivers. This location was selected because discharge data dating back to 1932 were available. Sample collection, sample laboratory analysis, data reduction, and data publication are the responsibility of the USGS Missouri District.

Sample and data collection procedures

Prior to sample collection, stream velocity measurements are made with a Price current meter, and these readings are used to compute discharge. Based on the discharge calculations, five verticals are then sampled by the equal-discharge-increment method (i.e. positioned at intervals such that the discharge flowing through the stream cross-sectional area represented by each vertical will be one fifth of the total computed discharge). A US P-63 sampler mounted on a monorail below the Thebes railroad bridge is used to collect depth-integrated samples, and a single pint-bottle sample is collected for the two-way trip. Sediment-load computations are made from only the samples taken on the second and fourth verticals; chemical and biological analyses are run on samples from the other three verticals. A paid observer has taken daily specific conductance samples and has read their temperatures since January 1973.

The gaging record in the vicinity of Thebes began in November 1878, and the discharge records date to October 1932. The following tabulation presents the gaging and recording devices used, as well as the agencies collecting these data and the gaging localities used:

Period	Locality	Device Used
	U. S. Engineer Office, St. Louis (now U. S. Army Engineer District, St. Louis (SLD)	
November 1878 - January 1879	Grays Point, Missouri (mile 46.4)	Staff gage
	Mississippi River Commission	
January 1879 - May 1896	Grays Point, Missouri (mile 46.4)	Staff gage
May 1896 - 1904	Cape Girardeau, Missouri (mile 51.9)	Staff gage
	U. S. Weather Bureau (now National Weather Service)	
February 1891 - February 1894; 1904 - 5 April 1941	Cape Girardeau, Missouri (mile 51.9)	Staff gage
5 April 1941 - 12 October 1943	Thebes, Illinois (mile 43.7)	Staff gage
12 October 1943 - 2 October 1952	Thebes, Illinois (mile 43.7)	Friez continuous water-stage recorder
2 October 1952 - present	Thebes, Illinois (mile 43.7)	Stevens Type T-4 telemark recorder
	USGS	
5 April 1941 - present	Thebes, Illinois (mile 43.7)	Wire-weight gage
24 September 1952 - 1 November 1973	Thebes, Illinois (mile 43.7)	Stevens A-35 recorder
1 November 1973 - present	Thebes, Illinois (mile 43.7)	Fisher-Porter automatic digital recorder

Since 1 October 1943, the former gage at Cape Girardeau, Missouri, (mile 51.9) has been used as an auxiliary gage to determine fall for discharge computation at a slope station. Discharge measurements are normally made once each week from the monorail car suspended beneath the Thebes railroad bridge. During flooding, these measurements are taken

more frequently, sometimes with the assistance of the SLD personnel.

Laboratory sample analysis

Information is identical to that presented for the Des Moines River sediment sample collection station at St. Francisville, Missouri.

Data reduction procedures

Information is identical to that presented for the Des Moines River sediment sample collection station at St. Francisville, Missouri.

Data reporting procedures

Daily discharge values from the Thebes gaging station were published prior to 1961 in References 12 and 31. Since 1961, these data have been published in References 21, 31, and 32. Daily water temperatures have been published in Reference 19 since 1968. Beginning with the volume to be published in 1976 for water year 1975, temperatures, conductivity, particle-size distributions, suspended-sediment concentrations, suspended-sediment loads, chemical constituents, and biological constituents will be published in References 18 and 19. No sample suspended-sediment load data are available. Daily values for temperature, conductivity, and discharge are added periodically to the Environmental Protection Agency's STORET System by the USGS personnel at Reston, Virginia. These values, as well as data on chemical constituents, biological constituents, and the sediment parameters, are also part of the USGS WRD Water-Quality Files. No examples of any of these data are available.

General information

Although the number of samples collected at this station since 1974 are not sufficient to draw any reasonable conclusions about sediment loads in this reach of the Mississippi River, this station is part of the nationwide NASQUAN network and will continue to operate indefinitely. The NASQUAN program is committed to fulfilling the long-term objectives of detection of trends in water quality.

Further information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, P. O. Box 340, 103 West Tenth Street, Rolla, Missouri 65401.

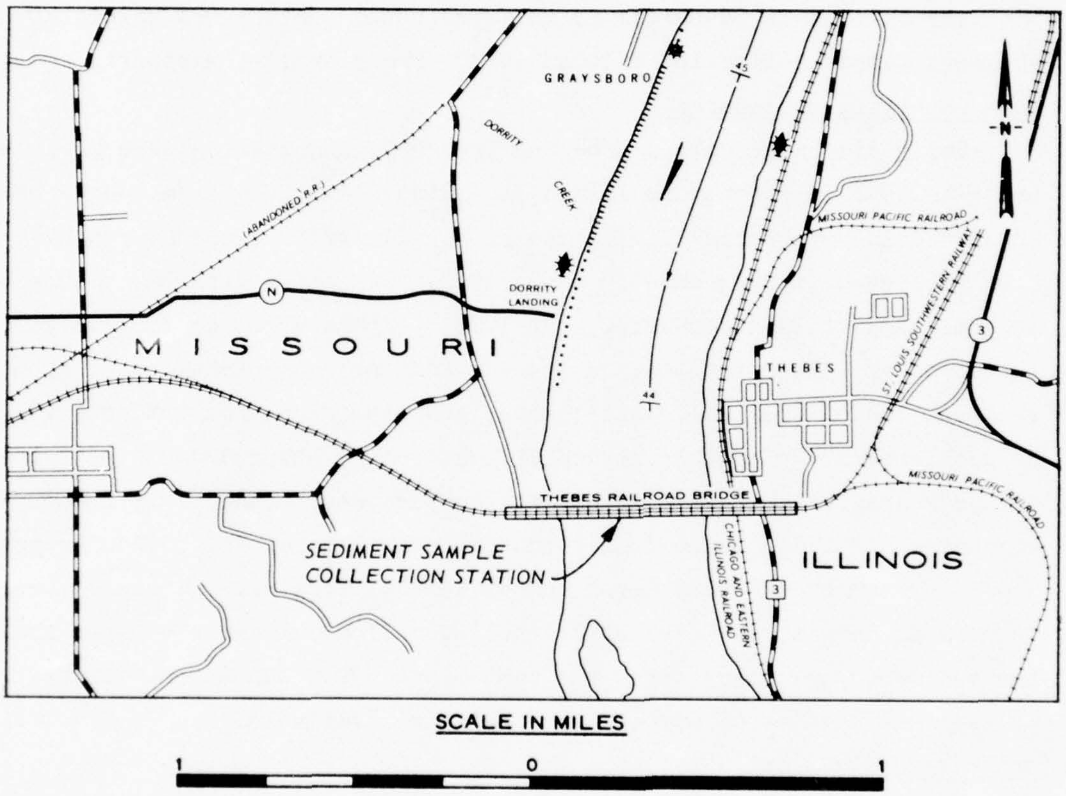


Figure A69. Site location for Thebes, Illinois, sediment sample collection station (Source: Charts 7 and 8, Upper Mississippi River Navigation Charts, U. S. Army Engineer Division, North Central, Chicago, Illinois, 1972)

Mississippi River at St. Louis, Missouri

Station identification

OWDC No.: 51870

Agency station No.: 07010000

Latitude/longitude: 383744/901047

Agency reporting to OWDC: USGS

River mile: 179.1 (Mile 0 is at the confluence of the Ohio and Mississippi rivers; established by the CE in 1930.)

Site description

From April 1948 to September 1968, suspended-sediment samples were collected from the MacArthur Highway and railroad bridge (mile 178.9), which crosses the Mississippi River and links the cities of St. Louis, Missouri, and East St. Louis, Illinois. In September 1968, the station was moved to its present location, the Poplar Street Bridge (Interstate Highways 55 and 70) 0.2 miles upstream (Figure A70). The stream-gaging station is on the Eads Highway and railroad bridge (mile 180.0). Both the left (or Illinois) bank and the right (or Missouri) bank are protected by riprap upstream from the station, and an artificial levee parallels the left bank along this reach. Between the sediment station and the gaging station on the right bank are the Gateway Arch and Riverfront Park. Upstream from the gaging station are a number of highway and railroad bridges and commercial docks. Lock and Dam No. 27 are located upstream at mile 185.6 and 190.3, respectively. The Missouri River enters the Mississippi River at mile 195.0. The urban and industrial areas of St. Louis and East St. Louis extend upstream from the sediment station for 6 miles and downstream for 4 miles along the left bank and 10 miles upstream and downstream along the right bank. The streambed material consists of silts, sands, and fine gravels, and the channel gradient is approximately 0.5 ft/mile. The discharges of record (1866 to the present) are: maximum - 1,019,000 cfs; mean - 176,800 cfs; and minimum - 18,000 cfs. The natural flow of the Mississippi River is affected by many navigation dams in the upper Mississippi River Basin

and by many dams and diversions for irrigation in the Missouri River Basin. The daily suspended-sediment loads of record (April 1948 to the present) are: maximum - 7,010,000 tons/day; estimated mean annual - 370,000 tons/day; and minimum - 2,800 tons/day.

Station chronological record

This station was established in April 1948 at a gaging station, with a long and reliable record, to monitor the sediment load contributed to the Mississippi River by the Missouri River. Sample collection, sample laboratory analysis, data reduction, and data publication are the responsibility of the USGS Missouri District.

Sample and data collection procedures

From April 1948 to September 1968, the USGS personnel collected sediment samples with a mobile crane at mile 178.9; since September 1968, the sediment samples have been collected at mile 179.1 from a trolley mounted on a monorail beneath the bridge. Stream velocity measurements are made prior to sampling. Throughout the period of record, sampling equipment, procedures, and frequency (once weekly except during high flows, when samples are taken once daily) have been the same. Prior to October 1974, only two depth-integrated verticals (centroids of equal discharge) were collected. Since October 1974, five discharge-weighted verticals have been collected with the second and fourth verticals of each series being used for sediment analysis and the remaining three verticals for chemical and biological analyses. A US P-63 sampler is used during periods of high flow, and a US P-61 sampler is used the remainder of the time. Each year an additional two to four suspended-sediment samples are taken along 18-20 verticals across the river by the equal-discharge-increment (EDI) method. Bed-material samples are collected at each vertical. The suspended-sediment samples and bed-material samples are analyzed for particle-size distribution. Reference 1a contains discussions of these samplers and the EDI method.

Water temperature has been measured weekly since October 1951. Chemical and biological sampling began in October 1973. Daily turbidity has been measured throughout the period of sediment record (April 1948

to the present) by personnel at the City of St. Louis Howard Bend water treatment plant on the Missouri River (mile 36.6) and by personnel at the East St. Louis water treatment plant on the Mississippi River (mile 178.2); these turbidity readings are used to define the concentration curve for St. Louis on those days when no suspended-sediment samples are taken (discussed under "Data reduction procedures").

The gaging station is on the Eads Highway and railroad bridge (mile 180.0). Although gaging at St. Louis dates to 1843, only gage-height data were obtained from 1843 to 1845 and from January 1861 to 1866. The period of record of discharge computations is from 1866 to 1927 (intermittent) and 1928 to the present. The tabulation below lists the devices used for gaging, recording, and transmitting data in the vicinity of the St. Louis gage:

Period	Device Used
Mississippi River Survey	
1843 - 1845	Staff gage
Mississippi River Commission (Mile 179.6)	
January 1861 - 30 June 1928	Staff gage
U. S. Engineer Office, St. Louis (Mile 179.6) (now U. S. Army Engineer District, St. Louis (SLD))	
1 July 1928 - present	Staff gage in three sections
U. S. Weather Bureau (now National Weather Service (Mile 180.0))	
1872 - 14 December 1934	Staff gage
14 December 1934 - 5 January 1953	Automatic water-stage telerecorder
5 January 1953 - present	Stevens Type T-4 Telemark gage
USGS (Mile 180.0)	
16 March 1933 - 5 May 1934	Staff gage in three sections (property of SLD)
5 May 1934 - 10 December 1952	Stevens continuous water-stage recorder

(Continued)

Period	Device Used
USGS (Mile 180.0) (Continued)	
11 October 1935 - present	Veatch patent tape gage; later replaced by Type A wire-weight gage
10 December 1952 - present	Stevens A-35 recorder
2 October 1973 - present	Fisher-Porter automatic digital recorder (1-hr intervals)
February 1976 - present	Satellite platform to transmit data via satellite to a ground station in Bay St. Louis, Mississippi

Laboratory sample analysis

Information is identical to that presented for the Des Moines River sediment sample collection station at St. Francisville, Missouri.

Data reduction procedures

Prior to 1967, computations of suspended-sediment loads were made by hand, and since that date, the automated data reduction procedure has been identical to that presented for the Des Moines River sediment sample collection station at St. Francisville, Missouri.

To calculate the suspended-sediment load when no samples are taken, the weighted mean turbidity is used. The turbidity is computed by multiplying the value measured at the Howard Bend treatment plant by the difference between the discharge at the Alton, Illinois, gaging station and the discharge at St. Louis, allowing a one- day time lag between Howard Bend and the St. Louis station. Turbidity at the East St. Louis water treatment plant is then multiplied by the discharge at Alton, and the sum of these two determinations is divided by the discharge at the St. Louis station to compute the weighted mean turbidity.

Sediment concentrations on days of sampling are used to derive a coefficient related to the weighted mean turbidity for that day. A graph can then be constructed relating sediment concentration to the weighted mean turbidity for those days when samples are not taken. Concentrations measured on the two verticals are used for those days when samples are taken. Daily suspended-sediment loads are computed by

multiplying the product of the mean concentration in the cross section and the water discharge by 0.0027. Reference 1c contains a discussion of the data reduction procedures.

Data reporting procedures

The intermittent discharge measurements collected from 1866 through 1927 and the daily discharge measurements collected from 1928 through 1944 are in reports of the Mississippi River Commission. From 1933 to 1961, daily discharge values were published annually in References 12 and 31, and since 1961, these data have been published in References 21, 31, and 32. Daily temperatures and sediment loads were published prior to 1961 in Reference 16, and since 1961, these data have been published in Reference 18. Biological and chemical data have been included in Reference 18 beginning with the 1974 edition. A sample of the sediment data is shown as Figure A71. Daily values for temperature and discharge are added periodically to the Environmental Protection Agency's STORET System by the USGS personnel at Reston, Virginia. These values, as well as data on chemical constituents, biological constituents, and sediment parameters, are also part of the USGS Water Resources Division's Water-Quality Files.

General information

The stream sediment and gaging records for this station are considered to be very reliable. A number of analytical studies have been performed using these data (e.g. Reference 33).

Further information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, P. O. Box 340, 103 West Tenth Street, Rolla, Missouri 65401.

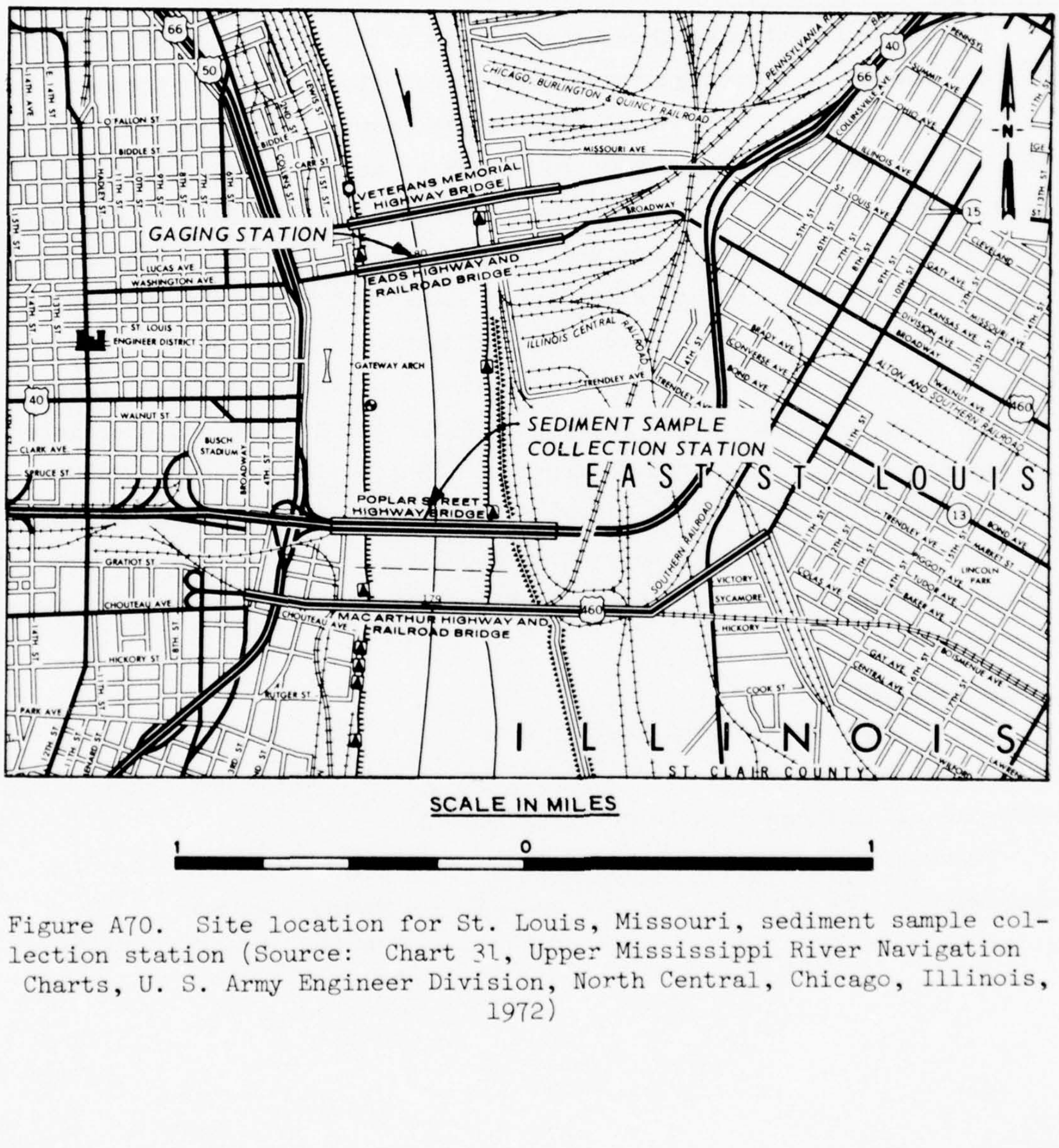


Figure A70. Site location for St. Louis, Missouri, sediment sample collection station (Source: Chart 31, Upper Mississippi River Navigation Charts, U. S. Army Engineer Division, North Central, Chicago, Illinois, 1972)

MISSISSIPPI RIVER MAIN STEM

07010000 MISSISSIPPI RIVER AT ST. LOUIS, MO.

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	361000	983	958000	245000	280	185000	290000	258	202000
2	387000	1600	1670000	246000	267	177000	270000	262	191000
3	400000	1260	1360000	239000	254	164000	254000	292	200000
4	417000	1050	1180000	233000	232	146000	255000	308	212000
5	432000	887	1030000	225000	228	139000	302000	300	245000
6	443000	809	968000	211000	246	140000	372000	319	320000
7	447000	970	1170000	205000	254	141000	408000	552	608000
8	435000	737	866000	212000	238	136000	417000	635	715000
9	394000	704	749000	213000	238	137000	382000	708	730000
10	318000	612	525000	202000	219	119000	329000	719	639000
11	269000	551	400000	196000	237	125000	282000	716	545000
12	251000	445	302000	190000	202	104000	251000	447	303000
13	271000	289	211000	185000	200	99900	237000	356	228000
14	373000	239	241000	179000	257	124000	224000	298	180000
15	390000	477	502000	184000	222	110000	220000	240	143000
16	383000	924	956000	179000	272	131000	204000	216	119000
17	386000	890	928000	176000	277	132000	187000	217	110000
18	399000	962	1040000	178000	244	117000	168000	220	99800
19	409000	990	1090000	171000	240	111000	168000	184	83500
20	405000	536	586000	164000	235	104000	157000	156	66100
21	397000	654	701000	179000	235	114000	133000	162	58200
22	390000	675	711000	185000	253	126000	133000	158	56700
23	369000	519	517000	210000	221	125000	149000	190	76400
24	333000	428	385000	241000	245	159000	160000	142	61300
25	299000	405	327000	261000	366	258000	187000	137	69200
26	279000	379	286000	278000	914	686000	257000	185	128000
27	266000	496	356000	291000	716	563000	280000	386	292000
28	262000	339	240000	299000	458	370000	292000	365	288000
29	260000	331	232000	312000	347	292000	292000	323	255000
30	246000	283	188000	305000	322	265000	274000	430	318000
31	245000	281	186000	--	--	--	253000	444	303000
TOTAL	916000	--	20861000	6594000	--	5599900	7787000	--	7845200

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	215000	512	297000	468000	934	1180000	279000	435	328000
2	200000	459	248000	451000	858	1040000	270000	402	293000
3	190000	387	199000	427000	807	930000	266000	341	245000
4	175000	372	176000	407000	624	686000	265000	281	201000
5	160000	338	146000	384000	624	647000	264000	258	184000
6	155000	277	116000	358000	570	551000	275000	277	206000
7	150000	209	84600	326000	479	422000	294000	264	210000
8	145000	174	68100	287000	504	391000	313000	327	276000
9	141000	181	68900	269000	478	347000	319000	523	450000
10	146000	127	50100	260000	387	272000	319000	493	425000
11	140000	205	77500	248000	340	228000	329000	398	354000
12	123000	136	45200	230000	1310	814000	390000	483	509000
13	120000	131	42400	229000	1140	705000	437000	682	805000
14	126000	133	45200	231000	1120	699000	462000	774	965000
15	130000	130	45600	229000	690	427000	466000	896	1130000
16	132000	128	45600	225000	674	409000	458000	1050	1300000
17	134000	134	48500	217000	441	258000	443000	720	861000
18	160000	151	65200	211000	265	151000	424000	538	616000
19	212000	304	174000	218000	262	154000	409000	478	528000
20	264000	448	319000	249000	266	179000	391000	433	457000
21	330000	756	674000	290000	491	384000	371000	416	417000
22	368000	779	774000	311000	876	736000	342000	380	351000
23	395000	808	862000	323000	671	585000	316000	364	311000
24	408000	814	897000	338000	496	453000	301000	285	232000
25	399000	944	1020000	342000	389	359000	291000	268	211000
26	381000	858	883000	322000	502	436000	276000	287	214000
27	396000	816	872000	302000	715	583000	265000	281	201000
28	454000	792	971000	287000	631	489000	258000	292	203000
29	482000	873	1140000	--	--	--	251000	304	206000
30	482000	972	1260000	--	--	--	247000	334	223000
31	477000	898	1160000	--	--	--	248000	283	189000
TOTAL	7790000	--	12874900	8439000	--	14515000	239000	--	13101000

Figure A71. Example of sediment data for St. Louis, Missouri (Source: Water Resources data for Missouri, 1974, USGS, Rolla, Missouri) (sheet 1 of 2)

MISSISSIPPI RIVER MAIN STEM

07010000 MISSISSIPPI RIVER AT ST. LOUIS, MO.--Continued

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCENTRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCENTRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCENTRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)
1	256000	383	265000	297000	400	321000	487000	1010	1330000
2	260000	431	303000	307000	340	282000	528000	1120	1600000
3	256000	320	221000	324000	346	303000	532000	1160	1670000
4	256000	278	192000	339000	492	450000	514000	822	1140000
5	246000	256	170000	333000	400	360000	500000	849	1150000
6	242000	243	159000	324000	577	505000	467000	864	1090000
7	242000	208	136000	313000	682	576000	433000	834	975000
8	248000	312	209000	304000	587	482000	437000	989	1170000
9	257000	696	483000	292000	470	371000	456000	1300	1600000
10	263000	424	301000	278000	316	237000	480000	1160	1500000
11	272000	486	357000	268000	292	211000	492000	1180	1570000
12	287000	421	326000	265000	244	175000	497000	1280	1720000
13	298000	401	323000	259000	243	170000	508000	1320	1810000
14	298000	368	296000	259000	230	161000	500000	1400	1890000
15	299000	343	277000	275000	240	178000	482000	1210	1570000
16	303000	601	492000	332000	361	324000	465000	1010	1270000
17	303000	568	465000	372000	488	490000	449000	785	952000
18	310000	556	465000	367000	557	552000	428000	619	715000
19	309000	700	584000	379000	531	543000	407000	568	624000
20	308000	567	472000	448000	633	766000	390000	398	419000
21	307000	652	540000	505000	1920	2620000	377000	475	484000
22	305000	585	482000	540000	2200	3210000	373000	456	459000
23	308000	634	527000	563000	1650	2510000	370000	395	395000
24	308000	624	519000	579000	1580	2470000	366000	362	358000
25	329000	529	470000	579000	1380	2160000	362000	452	442000
26	341000	532	490000	557000	1830	2750000	362000	466	455000
27	326000	1340	1180000	523000	1610	2270000	370000	499	499000
28	318000	1640	1410000	483000	814	1060000	382000	497	513000
29	311000	1070	898000	453000	1130	1380000	397000	560	600000
30	302000	684	558000	430000	861	1000000	409000	515	569000
31	--	--	--	445000	868	1040000	--	--	--
TOTAL	8668000	--	13570000	1992000	--	29927000	3220000	--	30539000

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCENTRATION (MG/L)	JULY SEDIMENT DISCHARGE (TONS/DAY)	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCENTRATION (MG/L)	AUGUST SEDIMENT DISCHARGE (TONS/DAY)	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCENTRATION (MG/L)	SEPTEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	417000	459	517000	124000	167	55900	125000	235	79300
2	413000	427	476000	122000	167	55000	130000	286	100000
3	405000	407	445000	118000	158	50300	139000	194	72800
4	395000	424	452000	115000	244	75800	141000	131	49900
5	380000	465	477000	112000	171	51700	140000	193	73000
6	364000	428	421000	114000	162	49900	137000	203	75100
7	350000	446	421000	116000	143	44800	134000	253	91500
8	344000	526	489000	111000	152	45600	126000	262	89100
9	316000	848	724000	114000	141	43400	115000	268	83200
10	276000	908	677000	122000	143	47100	118000	255	81200
11	253000	757	517000	136000	138	50700	124000	238	79700
12	237000	521	333000	145000	199	77900	127000	258	88500
13	226000	363	222000	150000	202	81800	127000	258	88500
14	216000	311	181000	139000	174	65300	121000	261	85300
15	202000	173	94400	132000	163	58100	117000	263	83100
16	205000	190	105000	141000	124	47200	109000	183	53900
17	201000	193	105000	135000	106	38600	101000	207	56400
18	188000	237	120000	133000	100	35900	101000	196	53400
19	172000	255	118000	122000	180	59300	95600	190	49000
20	162000	284	124000	114000	132	40600	100000	322	86900
21	146000	205	80800	117000	133	42000	101000	235	64100
22	147000	178	70600	117000	122	38500	100000	220	59400
23	146000	149	58700	123000	117	38900	96300	168	43700
24	134000	165	59700	129000	198	69000	87400	155	36600
25	129000	157	54700	130000	210	73700	83800	127	28700
26	130000	154	54100	131000	238	84200	77700	136	28500
27	133000	144	51700	126000	252	85700	81400	135	29700
28	132000	149	53100	135000	211	76900	87200	125	29400
29	141000	178	67800	139000	197	73900	96400	135	35100
30	138000	177	66000	139000	324	122000	90700	245	60000
31	130000	178	62500	129000	378	132000	--	--	--
TOTAL	7228000	--	7698100	3930000	--	1911700	3329500	--	1935000

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 100132500

TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 160377800

Figure A71 (sheet 2 of 2)

Mississippi River Below Alton, Illinois

Station identification

OWDC No.: 93045

Agency station No.: 05587550

Latitude/longitude: 385141/900815

Agency reporting to OWDC: USGS

River mile: 199.7 (Mile 0 is at the confluence of the Ohio and Mississippi rivers; established by the CE in 1930.)

Site description

The sediment-sampling station is 3 miles downstream from the Alton gaging station (Figure A72). The gaging station is on the downstream side of the Clark Highway Bridge (U. S. Highway 67) in the tailwater of Lock and Dam No. 26 (mile 202.7). The banks upstream from the sampling station are protected with riprap for 1.5 miles. There is also riprap protection along the right (or Missouri) bank from mile 201.4 to mile 202.0, as well as one submerged wing dam on the left (or Illinois) bank at mile 201.3. An artificial levee parallels the entire bank from the sampling station upstream past the gaging station, and those portions of the right bank below the bluff line are protected by levees. The confluence of the Missouri and Mississippi rivers is 4.7 miles downstream from the sampling station. Along the left bank and extending for 5 miles upstream and 3 miles downstream from the station are the urban and industrial areas of Alton and Wood River, Illinois, including several commercial docks. The area along the right bank is mainly agricultural, but upstream of Lock and Dam No. 26 are a wildlife area and several recreational sites. The bed material consists of sands and fine gravels, and the channel gradient of this reach of the Mississippi River is approximately 0.5 ft/mile. The discharges of record (October 1927 to the present) are: maximum - 535,000 cfs; mean - 98,440 cfs; and minimum - 7,960 cfs. Streamflow is affected by numerous navigation dams and reservoirs in the upper Mississippi River Basin (especially Lock and Dam No. 26), as well as occasional Missouri River

flood backwaters. Overflow of the banks at Alton caused by Missouri River flooding occurred during 1943, 1944, 1947, 1951, and 1973. Flow is affected somewhat by ice during the winter. The seven suspended-sediment loads measured during the period of record (January 1975 to the present) ranged from 3,770 tons/day to 434,000 tons/day. No mean load has been computed for these seven values, because they were not evenly distributed throughout the year.

Station chronological record

This station was established by the USGS at a gaging station, with a long reliable record, in January 1975 as a part of the National Stream Quality Accounting Network (NASQUAN). Its purpose is to monitor sediment loads in the Mississippi River upstream from the confluence of the Missouri and Mississippi rivers. Sample collection, sample laboratory analyses, data reduction, and data publication are the responsibility of the USGS Missouri District.

Sample and data collection procedures

Information regarding the collection of stream velocity measurements and sediment samples is identical to that presented for the Mississippi River sediment sample collection station at Thebes, Illinois, with the following exceptions:

a. USGS personnel use a US P-61 sampler to collect sediment samples from a boat.

b. Collection of water-quality samples for determination of chemical and biological constituents as well as specific conductance began in June 1968.

Stream gaging at the Alton station (mile 202.7) is a cooperative effort of the USGS and the CE St. Louis District (SLD), but the official record is that measured with the USGS recorder. A tabulation of the various gaging and recording devices and the responsible agencies is presented below:

Period	Device Used
Missouri and Illinois Bridge and Belt Railroad (Mile 202.8)	
1890 - 1 January 1917	Staff gage

Period	Device Used
U. S. Weather Bureau (now National Weather Service) (Mile 202.8)	
1 January 1917 - 20 March 1933	Staff gage
USGS (Mile 202.8)	
20 March 1933 - present	Staff gage
16 November 1917 - present	Fisher-Porter automatic digital recorder driven by float tape (in concrete shelter of Lock and Dam No. 26)
SLD (Mile 202.7)	
11 July 1940 - present	Stevens continuous recorder later replaced by Stevens long-distance recorder (in control house of Lock and Dam No. 26)

An auxiliary gage equipped with a Stevens A-35 recorder at Hartford, Illinois (mile 196.8), is used to determine fall for discharge computation at a slope station; this gage was established on 11 July 1940, and prior to this date, various combinations of gages were used. Periodic instantaneous discharge measurements are made from the Missouri and Illinois Bridge and Belt Railroad bridge (mile 202.8). Flow is turbulent at the bridge and is greatly affected by flows through Lock and Dam No. 26.

Laboratory sample analysis

Information identical to that presented for the Des Moines River sediment sample collection station at St. Francisville, Missouri.

Data reduction procedures

Information is identical to that presented for the Des Moines River sediment sample collection station at St. Francisville, Missouri.

Data reporting procedures

Information is identical to that presented for the Mississippi

River sediment sample collection station at Thebes, Illinois. No examples of these data are available.

General information

Although the number of samples collected at this station since 1975 are not sufficient to draw any reasonable conclusions about sediment loads in this reach of the Mississippi River, this station is part of the nationwide NASQUAN network and will continue to operate indefinitely. The NASQUAN program is committed to fulfilling the long-term objectives of detection of trends in water quality.

Further information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, P. O. Box 340, 103 West Tenth Street, Rolla, Missouri 65401.

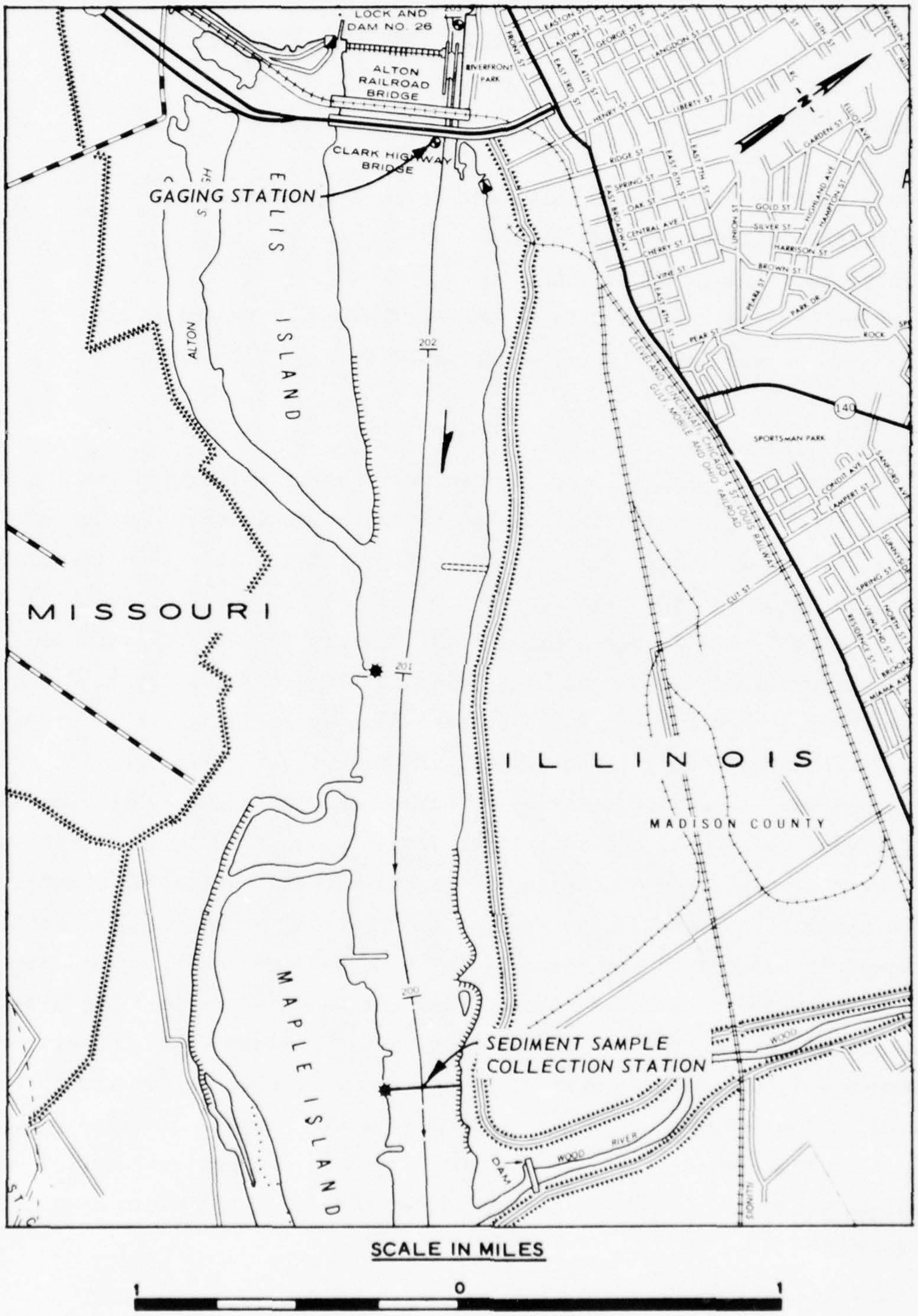


Figure A72. Site location for Alton, Illinois, sediment sample collection station (Source: Charts 34 and 35, upper Mississippi River Navigation charts, U. S. Army Engineer Division, North Central, Chicago, Illinois, 1972)

Mississippi River at Hannibal, Missouri

Station identification

OWDC No.: 54604

Agency station No.: None, only name is used by agency

Latitude/longitude: 394324/912149

Agency reporting to OWDC: CE

River mile: 309.2 (Mile 0 is at the confluence of the Mississippi and Ohio rivers; established by the CE in 1930.)

Site description

From 1943 through 1965, the sediment sample collection station was on the now-abandoned Wabash Railroad bridge approximately 2 miles downstream (about mile 307) from its present position. Since 1965, the station has been near the right (or Missouri) bank of the Mississippi River on the Mark Twain Highway Bridge (U. S. Highway 36), which joins Hannibal, Missouri, and East Hannibal, Illinois (Figure A73). It is 0.6 mile downstream from the Norfolk and Western Railway bridge and 15.7 miles downstream from Lock and Dam No. 21. Between the sampling station and Lock and Dam No. 21 are a series of submerged wing dams, submerged and upper bank revetment, and artificial levees along both banks. There are a number of scattered commercial docks and recreational sites upstream from the sampling station as well as the Hannibal urban area. Limestone bedrock is exposed in the channel, but some sand generally accumulates in the deepest portions. The channel gradient is 0.5 ft/mile. The discharges of record (1878 to the present) are: maximum - 414,000 cfs; and minimum - 5,000 cfs. No mean discharge is available. Flows are influenced to some degree by backwater from Lock and Dam No. 22 (mile 301.2). The estimated sediment loads of record (1943 to the present) are: maximum - 765,000 tons/day; mean - 75,000 tons/day; and minimum - 1,000 tons/day.

Station chronological record

This station was established in 1943 by the CE Rock Island District (RID) to be representative of the farthest downstream reach of the Mississippi River under its jurisdiction. The location was chosen because

of its proximity to a station with a long-term gaging record. Sample collection and data reduction are the responsibility of the RID. Sample laboratory analysis was handled by the RID until 1967; since 1967, the USGS Sedimentation Laboratory at Iowa City, Iowa, has analyzed the sediment samples. Neither streamflow nor sediment data have ever been published in any form.

Sample and data
collection procedures

Information regarding sediment sample collection procedures is identical to that presented for the Des Moines River station near Tracy, Iowa.

The gaging record in the vicinity of Hannibal, Missouri, began in 1871 when intermittent measurements were taken from a stone gage (i.e. a gage with notches carved into the limestone formation exposed at the river). Daily gage readings and the discharge record began in 1878. The following tabulation lists the gaging and recording devices used in the vicinity of Hannibal during the period of record and the agencies responsible for collecting these data:

Period	Locality	Device Used
	RID	
1871 - 1913	Wabash Railroad bridge (mile 307)	Stone gage
1913 - June 1967	Center pivot pier of Wabash Railroad bridge (mile 307)	Staff gage
22 July 1938 - present	Lock and Dam No. 22	Stevens Type F continuous water-stage recorder
June 1967 - present	Norfolk and Western Railway bridge (mile 309.8)	Enameled staff gage
	U. S. Weather Bureau (now National Weather Service)	
April 1892 - 1913	Wabash Railroad bridge (mile 307)	Stone gage

(Continued)

Period	Locality	Device Used
	U. S. Weather Bureau (now National Weather Service) (Continued)	
1913 - 12 June 1914	Center pivot pier of Wabash Railroad bridge (mile 307)	Staff gage
12 June 1914 - 28 June 1934	Center pivot pier of Wabash Railroad bridge (mile 307)	Marvin automatic river gage
28 June 1934 - 7 April 1966	Center pivot pier of Wabash Railroad bridge (mile 307)	Type A wire-weight and vertical enameled staff gages
7 April 1966 - present	Hannibal City Waterworks (mile 309.8)	Bristol resistance gage

Flows over 143,000 cfs are computed using the rating curve developed for the railway bridge; flows of 143,000 cfs and less are computed using the rating curve developed for Lock and Dam No. 22 (mile 301.2).

Laboratory sample analysis

Information is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa.

Data reduction procedures

Information is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa.

Data reporting procedures

Neither the daily streamflow nor the daily suspended-sediment load values are published. The RID, however, is attempting to obtain computer printouts (for in-house use at present) of its data at least as far back as 1968. A sample printout is shown as Figure A74.

General information

Information concerning this sediment sample collection station can be obtained from: District Engineer, U. S. Army Engineer District, Rock Island, Hydraulics Section, Clock Tower Building, Rock Island, Illinois 61201.

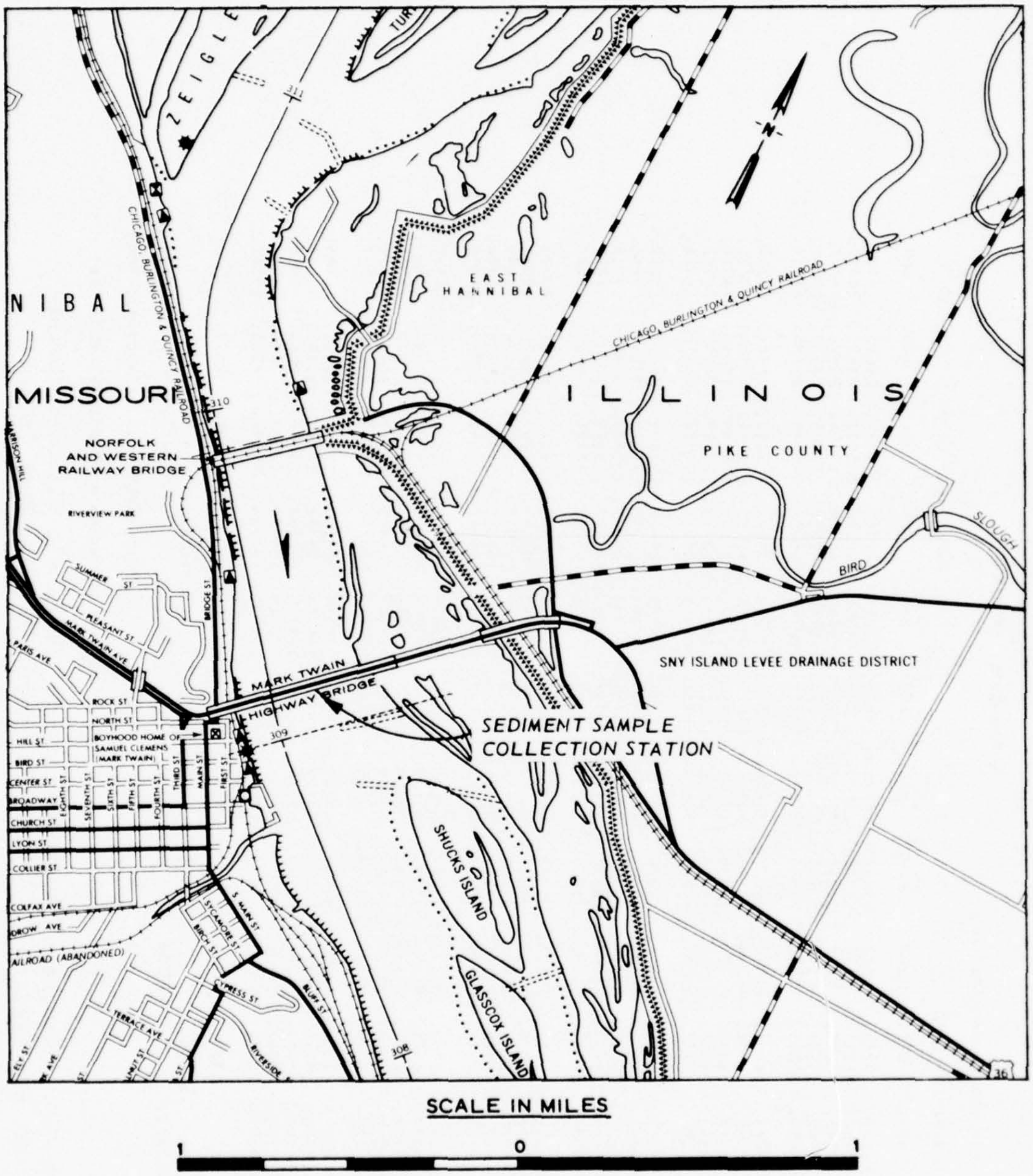


Figure A73. Site location for Hannibal, Missouri, sediment sample collection station (Source: Chart 55, Upper Mississippi River Navigation Charts, U. S. Army Engineer Division, North Central, Chicago, Illinois, 1972)

18 FEB 1976 STIMAN

MISSISSIPPI RIVER AT HANNIBAL MO.

DAILY SUSPENDED SEDIMENT LOAD WATER YEAR 1974

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1	98522.	61492.	7286.	9849.	55661.	20775.	14635.	170299.	242063.	300830.	29612.	5361.
2	91384.	48907.	11291.	9233.	51978.	37508.	14739.	81156.	252809.	280437.	25092.	36427.
3	98888.	46048.	12207.	7499.	37341.	75302.	15677.	156810.	303268.	254856.	23620.	106088.
4	52812.	42980.	14127.	5138.	29921.	59781.	11228.	141968.	372550.	238905.	17298.	56646.
5	235522.	34654.	22501.	5840.	24396.	66875.	152934.	82768.	104340.	238858.	26295.	38313.
6	186485.	30783.	24066.	24870.	21278.	74695.	145775.	132163.	39247.	215243.	26304.	48389.
7	59855.	17362.	21776.	26778.	16124.	88812.	25800.	190919.	17515.	192585.	7836.	50791.
8	57429.	20229.	24272.	27960.	17338.	119182.	51913.	201375.	86120.	168469.	19443.	26876.
9	178928.	17073.	23360.	26360.	15014.	112841.	212110.	108881.	113712.	125188.	26250.	21610.
10	209046.	15062.	17355.	26440.	15565.	230178.	188311.	21443.	26018.	131513.	22619.	11021.
11	204268.	15617.	13471.	27471.	15234.	187062.	71433.	22382.	69494.	134421.	25701.	10263.
12	212496.	14866.	10695.	31759.	26715.	34772.	37419.	140684.	107793.	137965.	47058.	9480.
13	347082.	13020.	11780.	33869.	21415.	32392.	23152.	391204.	95346.	123428.	38441.	9908.
14	277981.	13563.	13831.	31705.	24526.	37180.	29956.	358203.	49917.	103088.	24161.	7895.
15	237029.	14557.	10935.	31592.	21371.	73315.	32189.	154502.	61709.	145786.	28912.	15568.
16	118475.	13328.	7845.	32623.	22348.	70422.	69877.	111489.	65585.	138856.	11003.	37743.
17	138305.	8158.	7005.	32417.	24330.	40277.	142438.	127373.	88139.	62258.	29789.	14621.
18	180504.	8776.	12701.	35981.	25392.	28784.	213711.	178389.	177537.	52526.	26174.	2446.
19	161812.	9974.	10882.	38411.	26827.	21875.	281883.	258663.	187103.	51067.	15746.	2466.
20	234251.	10067.	7146.	36529.	28414.	90877.	210883.	764010.	186504.	34262.	15709.	12350.
21	234830.	7390.	12576.	30273.	21464.	106189.	87700.	842878.	194095.	33565.	16279.	28947.
22	127911.	8237.	10501.	51290.	27277.	140465.	103266.	345307.	219399.	34781.	20941.	12499.
23	108616.	8727.	12827.	41241.	27543.	93854.	79199.	249495.	211471.	73384.	21239.	4351.
24	103668.	8050.	11568.	23953.	29952.	78768.	74059.	208605.	218465.	67100.	32443.	4671.
25	115511.	8559.	13598.	21793.	33032.	64416.	82246.	274645.	246791.	36462.	44138.	3527.
26	93772.	9710.	16414.	18612.	30647.	55549.	101150.	269469.	233030.	19521.	28367.	585.
27	92490.	13706.	10716.	22015.	26940.	54779.	122794.	285701.	94421.	18365.	15093.	548.
28	83876.	14282.	10739.	21786.	20729.	44369.	144245.	278265.	296644.	21116.	2893.	2815.
29	78928.	15708.	9583.	19431.		27446.	152609.	183569.	306450.	23054.	849.	6696.
30	73980.	13098.	12949.	19011.		12107.	217411.	119399.	299939.	32802.	1330.	19763.
31	66240.		12221.	26181.		13866.		206537.		25605.	2178.	
	4560894.	563983.	418225.	797910.	738772.	2194714.	3110744.	7058551.	4967474.	3516297.	672815.	608664.

YEARLY TOTAL = 29209042. TONS

TOTAL YEARLY DISCHARGE = 91231519. ACRE FEET

Figure A74. Example of sediment data for Hannibal, Missouri (print-out provided by U. S. Army Engineer District, Rock Island)

Mississippi River at Keokuk, Iowa

Station identification

OWDC No.: CE, 54614; USGS, 06825

Agency station No.: CE, none; USGS, 5474500

Latitude/longitude: 402335/912225

Agency reporting to OWDC: CE; USGS

River mile: 363.9 (Mile 0 is at confluence of the Ohio and Mississippi rivers; established by the CE in 1930.)

Site description

The sediment sample collection station is on a slight bend of the Mississippi River on the Toledo, Peoria, and Western Railroad - U. S. Highway 218 Bridge, which joins Keokuk, Iowa, and Hamilton, Illinois (Figure A75). It is in the tailwater of Locks and Dam No. 19 and the Union Electric Company powerhouse (0.6 mile downstream from the dam and 0.4 mile downstream from the stream gaging station). The left (or Illinois) bank is unprotected, while the right (or Iowa) bank is partially protected with riprap revetment along the right-of-way of the Chicago, Burlington, and Quincy Railroad. There are concrete walls protecting the right bank along the lock chambers. On the left bank at the foot of the railroad-highway bridge is Montebello State Park, which has boat launching facilities. Illinois State Highway 10 parallels the left bank for 0.4 mile. The confluence of the Des Moines and Mississippi rivers (the Iowa-Missouri State line) is 2.5 miles downstream. The urban and industrial areas of Keokuk-Hamilton extend 2 miles upstream and downstream from the sediment collection station. Limestone bedrock is exposed in the channel, but some sands collect in the trough. Channel gradient in the vicinity of the station is 0.5 ft/mile. The discharges of record (1 January 1878 to the present) are: maximum - 344,000 cfs; mean - 62,570 cfs; and minimum - 5,000 cfs. Flows are governed by Locks and Dam No. 19. Daily sediment load data for the period of record is unavailable, but the mean load for water year 1968 was 7,093 tons/day.

Station chronological record

The sediment collection station was established by the CE Rock Island District (RID) in 1943 near a long-term (since 1878) stream gaging station as an intermediate point on that portion of the Mississippi River under the jurisdiction of the RID. In October 1974, the USGS Iowa District established a monthly water-quality sampling station at this location as part of the National Stream Quality Accounting Network (NASQUAN). Stream gaging is the responsibility of the Union Electric Company (formerly the Mississippi River Power Company). The USGS Iowa District is responsible for sample collection, sample laboratory analysis, data reduction, and data publication for its NASQUAN station. For the CE station, sample collection and data reduction are the responsibility of the RID; sample laboratory analysis was handled by the RID from 1943 through 1967 and by the USGS Iowa District since 1967. Sediment data have never been published in any form by the RID.

Sample and data collection procedures

Information regarding sediment sample collection for the CE station is identical to that presented for the Des Moines River sediment sample collection station at Tracy, Iowa.

Once a month the USGS Iowa District makes stream velocity measurements prior to collecting sediment samples and then collects three to five discharge-weighted, depth-integrated (ascending trip only) verticals from the railroad-highway bridge (except during the winter when only one vertical is taken). A US P-61 sampler mounted on a Matthes crane attached to a garden tractor is used. This sampler is described in Reference 1a.

The gaging record in the vicinity of Keokuk, Iowa, began in 1878. The tabulation below summarizes the gaging and recording devices used during the period of record as well as the agencies responsible for collecting these data:

Period	Locality	Device Used
	RID	
1 January 1878 - May 1913	Lower end of Old Keokuk Lock, Galland, Iowa (mile 371.9)	Stone gage markings cut into rock formation)
May 1913 - November 1957	Tailwater of Locks and Dam No. 19 (mile 363.9)	Staff gage
May 1913 - ?	Tailwater of Locks and Dam No. 19 (mile 363.9)	Bristol weekly recording gage
November 1957 - present	Tailwater of Locks and Dam No. 19 (mile 363.9)	Stevens Type-F recorder
	Mississippi River Power Company (now Union Electric Company)	
1 January 1913 - present	Powerhouse of Dam 19 (mile 364.2)	15 rated turbines, and 119 rated slot gates

Laboratory sample analysis

Information regarding the analysis of samples from the CE station is identical to that presented for the Des Moines River Sediment sample collection station near Tracy, Iowa. Information regarding the analysis of samples from the USGS station is identical to that presented for the Cedar River sediment sample collection station at Cedar Rapids, Iowa. Chemical and biological analysis are run by the USGS Central Laboratory at Doraville, Georgia.

Data reduction procedures

Information regarding the reduction of data from the CE station is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa. The USGS Iowa District computes suspended-sediment loads based on the instanteous discharges measured for only the days the samples are taken; the discharges are checked against the Union Electric Company values.

Data reporting procedures

No sediment data have ever been published in any form by the RID,

but Figure A76 is a sample printout provided by the RID from its files. The USGS publishes the sediment and water-quality data in Reference 14. Discharge data collected by Union Electric Company were published annually prior to 1961 in Reference 16 and since 1961 in Reference 15.

General information

Information concerning this station can be obtained from: District Engineer, U. S. Army Engineer District, Rock Island, Hydraulics Section, Clock Tower Building, Rock Island, Illinois 61201; or U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

Figure A75. Site location for Keokuk, Iowa, sediment sample collection station (Source: Chart 65, Upper Mississippi River Navigation Charts, U. S. Army Engineer Division, North Central, Chicago, Illinois, 1972)

22 MAR 1976

MISSISSIPPI RIVER AT KEOKUK IOWA

DAILY SUSPENDED SEDIMENT LOAD

WATER YEAR 1974

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1	33359.	11750.	25147.	4012.	96385.	14265.	32968.	62662.	329356.	383461.	15241.	3473.
2	31529.	10868.	23385.	1796.	101322.	12045.	46568.	98197.	300949.	161807.	14909.	4615.
3	37715.	10360.	17711.	1622.	84208.	18982.	41340.	222083.	192151.	130489.	12160.	4632.
4	51019.	8448.	18030.	2867.	59551.	35573.	43266.	263520.	164584.	100556.	10254.	3776.
5	34948.	8866.	35225.	1010.	44045.	45327.	45385.	185172.	172880.	65250.	10806.	3310.
6	27184.	7787.	42386.	656.	30642.	63047.	40870.	91682.	124643.	52046.	9778.	3156.
7	22758.	7257.	45791.	611.	28059.	81320.	56285.	51047.	51538.	46041.	10315.	2285.
8	23261.	6088.	49175.	534.	9940.	86155.	97568.	39600.	105124.	34103.	9645.	1956.
9	18009.	5241.	43178.	549.	7141.	95903.	51256.	30092.	148108.	29554.	10937.	2320.
10	17087.	4453.	32577.	515.	6149.	92725.	46306.	30853.	162432.	24048.	13804.	2261.
11	13820.	5195.	14847.	648.	3383.	86298.	54160.	33421.	160872.	22781.	12750.	2381.
12	16561.	3937.	7362.	1472.	2230.	124552.	71667.	40214.	247206.	18552.	15595.	2583.
13	17888.	4266.	7169.	200.	9000.	152421.	78043.	73398.	281659.	12579.	16706.	3180.
14	19968.	8634.	8801.	128.	17068.	129659.	87407.	112892.	287643.	15022.	16542.	3213.
15	20968.	15269.	11580.	130.	3547.	109363.	67915.	100979.	311043.	18436.	14313.	3440.
16	20677.	13922.	11534.	201.	3106.	94647.	54700.	84674.	302513.	15888.	13956.	3065.
17	20342.	13071.	9729.	471.	4490.	74562.	76076.	270619.	210860.	11180.	12734.	2682.
18	19157.	9793.	9020.	734.	6574.	50712.	101983.	325413.	194243.	9295.	9448.	2362.
19	16582.	11795.	4805.	689.	6857.	50850.	111322.	450337.	198313.	6994.	7094.	2646.
20	16013.	13162.	2317.	660.	4736.	42342.	124645.	911787.	196488.	5350.	5832.	2741.
21	12629.	15201.	3279.	3336.	4426.	42127.	93461.	1136926.	285808.	5000.	5495.	2692.
22	16718.	17823.	5507.	11274.	7439.	32072.	79862.	1162120.	386018.	4907.	5089.	3109.
23	22656.	22075.	4474.	20188.	13081.	35145.	59203.	1026719.	437079.	4536.	4527.	3910.
24	20013.	18089.	7636.	27355.	20622.	23605.	54402.	693196.	513538.	6162.	5002.	2701.
25	19126.	14260.	2177.	28287.	32030.	13476.	62827.	557223.	597773.	12654.	6208.	1794.
26	17278.	11276.	2323.	13561.	19580.	18943.	74950.	415840.	639894.	14240.	7472.	1690.
27	17581.	12621.	5231.	60761.	17041.	20578.	73133.	313709.	556762.	21217.	7200.	1838.
28	17015.	15865.	7992.	135364.	16109.	19991.	71304.	244708.	363765.	19796.	6220.	2614.
29	15138.	17514.	10600.	163025.		13628.	61965.	222245.	298844.	16995.	4368.	3850.
30	14621.	24831.	9537.	150407.		15651.	54255.	339951.	266124.	14626.	3305.	3285.
31	13228.		6000.	96122.		26590.		265462.		12428.		
	664849.	349718.	484527.	729187.	658760.	1723557.	2015094.	9856742.	8488211.	1295993.	30.	87558.

YEARLY TOTAL = 26655209. TONS

TOTAL YEARLY DISCHARGE = 67846808. ACRE FEET

Figure A75. Example of sediment data for Keokuk, Iowa (printout provided by U. S. Army Engineer District, Rock Island)

Mississippi River at Burlington, Iowa

Station identification

OWDC No.: 54603

Agency station No.: None, only name is used by agency

Latitude/longitude: 404753/910539

Agency reporting to OWDC: CE

River mile: 403.1 (Mile 0 is at the confluence of the Ohio and Mississippi rivers; established by the CE in 1930.)

Site description

The sediment sample collection station is on the Chicago, Burlington, and Quincy Railroad bridge, 7.5 miles downstream from Lock and Dam No. 18 (Figure A77). This bridge crosses a relatively straight reach of the Mississippi River and links Burlington with Gulfport, Illinois. The MacArthur Highway (U. S. Highway 34) is 1.1 miles upstream. Between the sediment station and Lock and Dam No. 18 are several small boat marinas and commercial docks mainly on the right (or Iowa) bank. Artificial levees parallel both banks between the sediment station and the dam. In addition, there a number of wing dams (mostly submerged) and some riprap bank protection along both banks. The Burlington urban and industrial areas extend upstream from the station for 2.5 miles. Two minor tributaries (Flint River and Yellow Spring Creek Diversion Ditch) enter the right bank of the Mississippi River between the sediment station and Lock and Dam No. 18. Sands constitute the bulk of the streambed material at Burlington, and the channel gradient of the Mississippi River in this reach is 0.5 ft/mile. The maximum and minimum discharges of record (1878 to the present) are 312,600 cfs and 5,000 cfs, respectively; no mean discharge value is available. The estimated sediment loads of record (1942 to the present) are: maximum - 200,000 tons/day; mean - 30,000 tons/day; and minimum - 800 tons/day.

Station chronological record

The sediment sample collection station was established in 1942 by the CE Rock Island District (RID) as an intermediate point on that

portion of the Mississippi River under its jurisdiction. This station is near a CE gaging station with a long-term record. Sample collection and data reduction are the responsibility of the RID. Laboratory sample analysis was handled by the RID until 1967; since 1967, the USGS Iowa District has analyzed sediment samples at its Sedimentation Laboratory in Iowa City, Iowa. Neither discharge nor sediment data have ever been published in any form.

Sample and data
collection procedures

Information regarding sediment sample collection procedures is identical to that presented for the Des Moines River sediment collection station at Tracy, Iowa.

The gaging record in the vicinity of Burlington began in 1869, when a permanently mounted staff gage was placed on the railroad bridge (mile 403.1). Discharge records began on 1 August 1878. Since 8 September 1937, discharges have been computed using the slope across the reach of a base gage in the tailwater of Lock and Dam No. 18 (mile 410.4) and an auxiliary gage at the Burlington City Waterworks (mile 403.3). The tabulation below presents the gaging and recording devices used in the vicinity of Burlington during the period of record and the agencies responsible for collecting these data:

Period	Locality	Device Used
	Chicago, Burlington, and Quincy Railroad	
1869 - 1 August 1878	Railroad bridge (mile 403.1)	Staff gage
	RID	
1 August 1878 - 1937?	Railroad bridge (mile 403.1)	Staff gage
8 August 1937 - present	Burlington City Waterworks (mile 403.3) and tailwater of Lock and Dam No. 11 (mile 410.4)	Stevens Type F recorders

Period	Locality	Device Used
	U. S. Weather Bureau (now National Weather Service)	
1878? - 28 November 1961	Railroad bridge (mile 403.1)	Staff gage
28 November 1961 - present	100 ft downstream from railroad bridge (mile 403.1)	Type D resistance gage

Laboratory sample analysis

Information is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa.

Data reduction procedures

Information is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa.

Data reporting procedures

Information is identical to that presented for the Mississippi River sediment sample collection station at Hannibal, Missouri. A sample printout (provided by the RID) is shown as Figure A78.

General Information

Information concerning this sediment sample collection station can be obtained from: U. S. Army Engineer District, Rock Island, Hydraulics Section, Clock Tower Building, Rock Island, Illinois 61201.

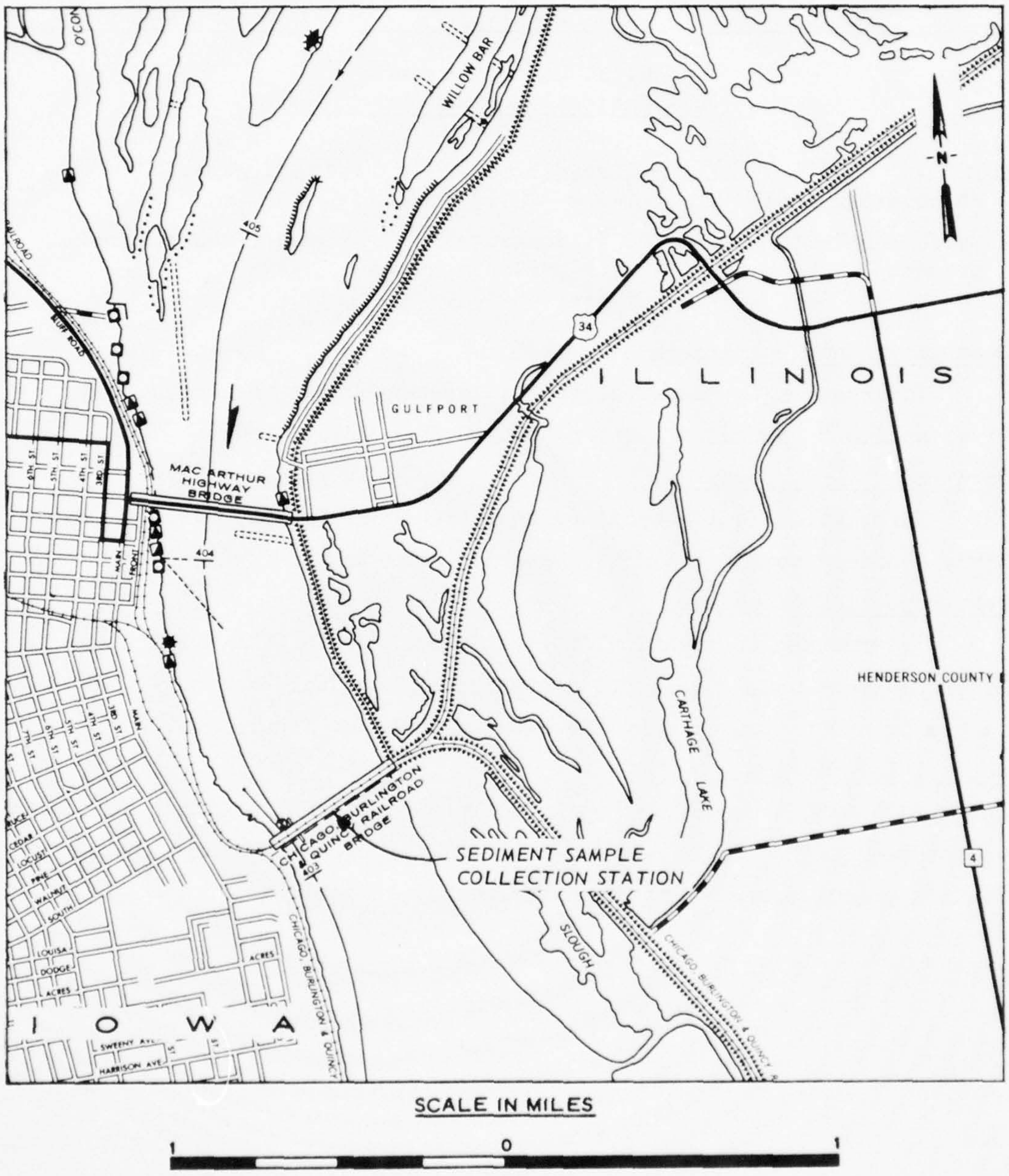


Figure A77. Site location for Burlington, Iowa, sediment sample collection station (Source: Chart 73, Upper Mississippi River Navigation Charts, U. S. Army Engineer Division, North Central, Chicago, Illinois, 1972)

14 APRIL 76 STIMAN

MISSISSIPPI RIVER AT BURLINGTON,IA.

DAILY SUSPENDED SEDIMENT LOAD WATER YEAR 1974

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1	45382.	14317.	9121.	1956.	66237.	18563.	46082.	327725.	232483.	125225.	4941.	5562.
2	44626.	11983.	8504.	2010.	69767.	38807.	48157.	269514.	190708.	107907.	4784.	6027.
3	39312.	9497.	10755.	1993.	51470.	35735.	47050.	209226.	178584.	96403.	4263.	6501.
4	27217.	8076.	16834.	1559.	42673.	37947.	32353.	147249.	138960.	78691.	3369.	7659.
5	36013.	6257.	18302.	1127.	44152.	121212.	29393.	188625.	113721.	58721.	3671.	7266.
6	48980.	6148.	18106.	961.	20438.	349752.	40901.	292788.	94188.	75244.	3796.	9212.
7	32025.	5724.	27166.	1248.	14011.	136954.	57473.	74070.	100195.	90792.	4039.	4371.
8	26861.	5291.	42353.	1558.	12451.	121208.	61697.	55867.	151623.	46236.	4761.	3980.
9	22645.	4500.	26574.	1285.	10286.	109065.	46170.	56347.	196810.	34639.	7352.	4816.
10	27810.	3833.	16649.	1613.	9889.	89721.	55123.	63633.	209339.	30471.	15369.	6975.
11	41171.	3869.	11621.	1324.	6186.	92061.	57460.	67371.	227601.	30997.	14631.	6287.
12	27067.	3614.	8518.	1172.	6524.	123283.	53935.	54967.	209102.	26241.	30731.	6346.
13	19865.	2797.	5851.	697.	5430.	80363.	63367.	68956.	190704.	27965.	27733.	9716.
14	20146.	2975.	4519.	1059.	5023.	72496.	69404.	71984.	156274.	49859.	33208.	10071.
15	21116.	3034.	4050.	2802.	4000.	74443.	88304.	147272.	150656.	42470.	34631.	8384.
16	21432.	3285.	3456.	3684.	3930.	56475.	148567.	326678.	152633.	30106.	31391.	6363.
17	28035.	3089.	3095.	1179.	5580.	46966.	163958.	312127.	149001.	20667.	27730.	6265.
18	32572.	2394.	2787.	686.	7331.	35348.	121344.	401052.	129304.	16855.	12835.	8290.
19	30704.	2441.	4002.	8468.	11464.	29053.	97385.	666088.	116270.	9432.	10226.	6029.
20	29076.	3573.	7550.	22379.	13968.	46196.	81641.	821233.	192395.	5392.	10129.	6039.
21	25435.	5676.	3825.	9680.	19324.	84949.	67962.	638532.	261977.	4969.	13684.	6430.
22	22622.	4838.	3801.	19079.	26564.	25868.	72970.	412027.	197696.	4873.	21075.	6718.
23	23027.	4804.	3622.	26371.	17189.	18250.	80684.	250525.	343828.	5598.	14911.	5594.
24	22419.	4537.	4655.	23786.	24861.	16781.	77589.	168120.	471520.	6081.	17610.	4202.
25	25025.	5713.	10257.	25573.	32263.	15376.	63971.	97094.	487794.	7270.	14222.	3542.
26	25346.	6487.	2806.	43497.	24209.	14830.	43296.	190051.	421704.	8265.	11518.	4856.
27	21078.	7802.	3698.	116423.	17911.	10996.	51336.	147648.	338073.	8174.	10398.	8051.
28	22324.	10144.	4355.	115458.	13981.	10012.	55254.	137422.	275581.	8702.	9889.	4253.
29	19087.	11240.	3660.	106075.		8748.	57345.	183875.	210088.	9841.	5788.	5755.
30	17632.	10860.	4559.	89910.		9089.	140385.	221540.	156303.	8804.	6247.	4875.
31	15791.		2484.	61330.		22694.		254221.		7632.	5833.	
	861842.	178798.	297535.	695942.	587112.	1953241.	2120557.	7323826.	6445118.	1084523.	420767.	190433.

YEARLY TOTAL = 22159694. TONS

TOTAL YEARLY DISCHARGE = 70622341. ACRE FEET

Figure A78. Example of sediment data for Burlington, Iowa (printout provided by U. S. Army Engineer District, Rock Island)

Mississippi River at East Dubuque, Illinois

Station identification

OWDC No.: 54612

Agency station No.: None, only name is used by agency

Latitude/longitude: 422950/903850

Agency reporting to OWDC: CE

River mile: 579.9 (Mile 0 is at the confluence of the Mississippi and Ohio rivers; established by the CE in 1930.)

Site description

The sediment sample collection station is on the downstream side and near the left (or Illinois) bank of the Illinois Central Railroad bridge, 0.8 mile downstream from the Wisconsin State line, and 3.1 miles downstream from Lock and Dam No. 11 (Figure A79). This reach of the Mississippi River is straight in the vicinity of the station. The left bank is unprotected and the right (or Iowa bank) is protected by riprap and concrete floodwalls along the Dubuque, Iowa, waterfront. The streambed material consists of sands, and the channel gradient is 0.5 ft/mile. Along the banks of the river near the station are the urban and industrial areas of Dubuque and East Dubuque. Upstream from the sediment station for 1 mile are several small commercial boat docks and recreational marinas (right bank). The Burlington Northern Railroad runs parallel to the river along the left bank and upstream from Lock and Dam No. 11. Several submerged wing dams have been placed perpendicular to both banks between the sediment station and Lock and Dam No. 11.

The discharges of record (October 1873 to the present) are: maximum - 304,500 cfs; and minimum - 6,500 cfs. No mean discharge value is available. The estimated sediment loads of record are: maximum - 123,000 tons/day; mean - 11,000 tons/day; and minimum - 500 tons/day.

Station chronological record

This sediment station was established in 1942 by the CE Rock Island District (RID) to be representative of the farthest upstream reach of the Mississippi River under its jurisdiction. It is on a

railroad bridge with a gage with a long-term record. Sample collection and data reduction have been the responsibilities of the RID throughout the period of record. Sample laboratory analysis was handled by the RID prior to 1967 and by the USGS, Iowa City, Iowa, since 1967. Sediment and discharge data have never been published in any form.

Sample and data collection procedures

The information regarding sediment sample collection procedures is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa.

The stream-gaging station at East Dubuque, Illinois, was established by the U. S. Signal Corps in October 1873 when a permanently mounted staff gage was installed on the Illinois Central Railroad bridge (mile 579.9). The tabulation lists the gaging and recording devices used at East Dubuque during the period of record and the agencies responsible for collecting these data:

Period	Device Used
U. S. Signal Corps	
October 1873 - 1893	Staff gage
U. S. Weather Bureau (now National Weather Service)	
October 1893 - present	Staff gage
? - present	Stevens Telemark gage
RID	
1893? - 24 August 1934	Staff gage
24 August 1934 - 8 November 1934	Canfield wire-weight gage
8 November 1934 - present	Stevens Type F continuous water-stage recorder

Flows of less than 83,000 cfs are computed using a rating curve prepared for Lock and Dam No. 11, and flows of 83,000 cfs and greater are computed using a rating curve prepared for this railroad bridge site.

Laboratory sample analysis

Information is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa.

Data reduction procedures

Information is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa.

Data reporting procedures

Information is identical to that presented for the Mississippi River sediment sample collection station at Hannibal, Missouri. A sample printout (provided by the RID) is shown as Figure A80.

General information

Information concerning the sediment sampling station on the Mississippi River at East Dubuque, Illinois, can be obtained from: U. S. Army Engineer District, Rock Island, Hydraulics Section, Clock Tower Building, Rock Island, Illinois 61201.

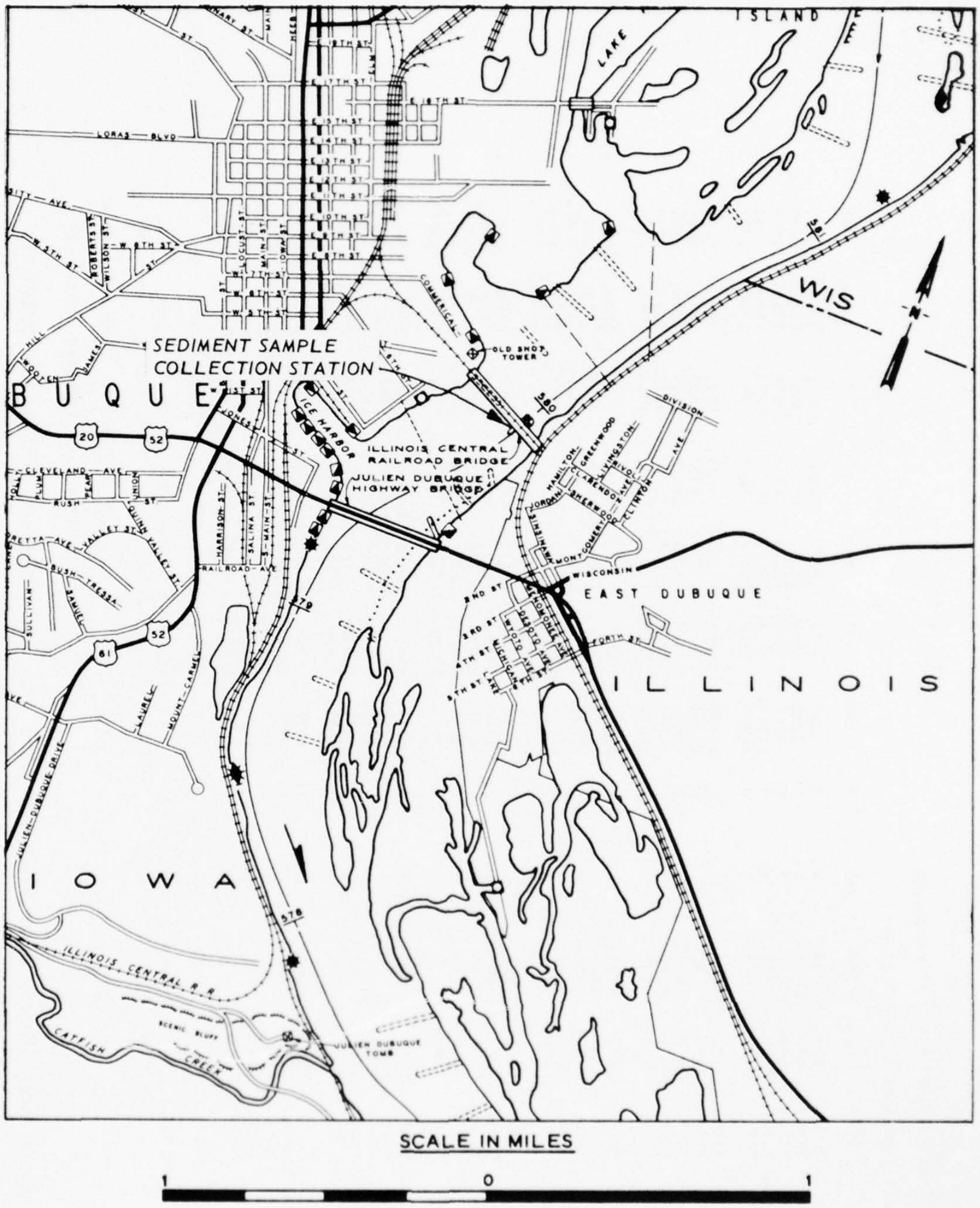


Figure A79. Site location for East Dubuque, Illinois, sediment sample collection station (Source: Chart No. 107, Upper Mississippi River Navigation Charts, U. S. Army Engineer Division, North Central, Chicago, Illinois, 1972)

MISSISSIPPI RIVER AT E.DUBUQUE

10 FEB 1976 STIMAN

DAILY SUSPENDED SEDIMENT LOAD

WATER YEAR 1974

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1	5103.	5254.	3348.	0.	0.	1339.	4498.	25666.	16087.	15210.	1980.	1542.
2	5048.	3643.	3085.	0.	0.	2162.	4874.	25107.	14273.	14015.	2146.	1755.
3	5270.	3446.	3278.	0.	0.	6910.	4565.	29126.	11274.	15238.	1912.	1550.
4	5083.	3745.	5033.	0.	0.	22357.	5364.	19299.	11011.	10253.	1876.	1443.
5	5743.	4157.	12828.	0.	0.	23064.	7707.	21278.	8696.	6487.	1724.	1372.
6	6098.	4178.	11291.	0.	0.	20798.	10988.	20362.	9125.	6176.	1905.	1401.
7	5734.	4450.	6820.	0.	0.	19212.	15436.	11789.	16387.	5945.	1891.	1200.
8	4884.	3879.	8068.	0.	0.	16494.	21462.	4825.	24035.	5617.	1998.	1155.
9	4781.	3319.	5192.	0.	0.	14354.	30331.	11378.	30719.	3747.	2364.	1299.
10	4334.	2501.	3093.	0.	0.	18099.	33296.	11991.	53071.	3921.	2544.	1539.
11	4917.	3001.	1243.	0.	0.	21906.	34915.	12782.	88187.	4102.	2882.	2161.
12	6229.	2199.	1494.	0.	0.	22136.	36599.	10318.	69608.	3855.	2410.	2027.
13	3758.	1932.	1899.	0.	0.	17723.	60335.	11979.	51842.	3324.	3089.	2343.
14	5197.	2028.	3129.	0.	0.	12003.	124724.	20035.	45573.	3108.	3095.	1864.
15	7728.	1995.	1284.	0.	0.	9869.	123145.	15163.	57084.	3557.	2371.	1715.
16	10472.	2393.	923.	0.	0.	12258.	69599.	13692.	69097.	3922.	2129.	1559.
17	8783.	2542.	953.	0.	0.	7448.	54601.	19551.	59054.	4254.	2102.	1640.
18	8116.	2298.	951.	0.	0.	4362.	40724.	15975.	40013.	2806.	1809.	1772.
19	8953.	2208.	1225.	0.	0.	4985.	44627.	14475.	37130.	1394.	1537.	1897.
20	9507.	2603.	1260.	0.	0.	2857.	57380.	32345.	112564.	1268.	1758.	1943.
21	8413.	2933.	1257.	0.	0.	4217.	65182.	109520.	382983.	1341.	1889.	1602.
22	9556.	2774.	1196.	0.	0.	5992.	74719.	100521.	461227.	1347.	2121.	1651.
23	11548.	2580.	1141.	0.	0.	9212.	74935.	40118.	295925.	1610.	2297.	1423.
24	12168.	3567.	1113.	0.	0.	4692.	55315.	31341.	152240.	1540.	2823.	1640.
25	13476.	4134.	1039.	0.	0.	2105.	42846.	27468.	121678.	1322.	3284.	1493.
26	12113.	3461.	1109.	0.	0.	1078.	37994.	26633.	97968.	2080.	2713.	1531.
27	12646.	3751.	1406.	0.	0.	1411.	39155.	21248.	82990.	4937.	1849.	1510.
28	10141.	6467.	1144.	0.	0.	1599.	29113.	18471.	45920.	7519.	2664.	1564.
29	7678.	6164.	0.	0.		1803.	30717.	17784.	35144.	5095.	1699.	2531.
30	4623.	3552.	0.	0.		3626.	31867.	17551.	30986.	20620.	1726.	2476.
31	4606.		0.	0.		4305.		15708.		3502.	2001.	
	233098.	101154.	65801.	0.	0.	300377.	1267013.	773501.	2531893.	169110.	68586.	50597.

YEARLY TOTAL = 5581129. TONS

TOTAL YEARLY DISCHARGE = 33551609. ACRE FEET

Figure A80. Example of sediment data for East Dubuque, Illinois (printout provided by U. S. Army Engineer District, Rock Island)

Mississippi River at McGregor, Iowa

Station identification

OWDC No.: None

Agency station No.: 05389500

Latitude/longitude: 430129/911021

Agency reporting to OWDC: USGS

River mile: 634.8 (Mile 0 is at the confluence of the Mississippi and Ohio rivers; established by the CE in 1930.)

Site description

The sampling station was established in July 1975 at the new U. S. Highway 18 Bridge that connects Marquette, Iowa, and Prairie du Chien, Wisconsin, across a double channel of the Mississippi River (Figure A81). It is 1.4 miles upstream from the stream-gaging station at McGregor, Iowa, and 13.2 miles downstream from Lock and Dam No. 9. Both channels carry nearly equal flow, but the west (or Iowa) channel that is narrower and deeper than the east (or Wisconsin) channel is maintained for navigation. Between the sediment sampling station and Lock and Dam No. 9 are a series of submerged wing dams, commercial docks, and recreational sites. Submerged riprap bank protection has been placed along sections of the right bank, but the left bank is unprotected. In the vicinity of the sampling station and for a distance of 1.5 miles upstream, both banks are adjacent to the urban and industrial areas of Marquette-McGregor-Prairie du Chien. Along the right (or Iowa) bank from mile 636.1 through mile 639.3 is the Effigy Mounds National Monument. The bed material is sand, and the channel gradient is 0.6 ft/mile. The stage-discharge relation is affected by backwaters from the Wisconsin River and Lock and Dam No. 10 (mile 615.0 near Guttenberg, Iowa). The discharges of record (1936 to the present) are: maximum - 276,000 cfs; mean - 33,830 cfs; and minimum - 6,200 cfs. No estimates of sediment load are available.

Station chronological record

This station was established in July 1975 by the USGS as part of the Great I River Study, Sediment and Erosion Program (an interagency

effort) and was operated until December 1975. Sampling was resumed in mid-March 1976. Sample collection, sample laboratory analysis, data reduction, and data publication are the responsibilities of the USGS Iowa District, Iowa City, Iowa.

Sample and data collection procedures

Sample collection is handled by paid observers under contract to the USGS. Twice weekly two depth-integrated vertical samples are taken in the west (or Iowa) channel with a trailer-mounted, electrically operated US P-46 sampler modified to use a US P-61 head. Every other week, three depth-integrated vertical samples are collected from both channels. Spacing between verticals is proportional to channel width. Every six weeks the USGS Iowa District personnel collect equal-transit-rate (ETR) cross sections, as well as bed-load (using a Helley-Smith sampler) and bed-material samples from both channels. Samples were collected from July to December 1975 and discontinued during the winter months. Sampling was resumed in mid-March 1976. The use of these samplers and the ETR method are discussed in Reference 1a. Sampling will continue on a long-term basis.

Discharges are computed using the slope between the base gage at McGregor (mile 633.4) and an auxiliary gage in the tailwater of Lock and Dam No. 9 (mile 647.5). The base station was established on 15 May 1936 by the USGS Iowa District (the only agency ever to collect river stage data at this locality). The auxiliary gage is maintained in cooperation with the CE St. Paul District (SPD). (The SPD personnel collect the gaging data, and the USGS Iowa District keeps the actual records.) The tabulation below presents the gaging and recording devices used at both McGregor and Lock and Dam No. 9 during the period of record:

Period	Locality	Device Used
15 August 1936 present	McGregor, Iowa (mile 633.4)	Stevens A-35 water-stage recorder
15 August 1936 - 31 May 1937	Tailwater of Lock and Dam No. 9 (mile 647.5)	Stevens (?) water-stage recorder

Period	Locality	Device Used
1 June 1937 - 1 June 1939	Tailwater of Lock and Dam No. 9 (mile 647.6)	Nonrecording gage
2 June 1939 - present	Tailwater of Lock and Dam No. 9 (mile 647.5)	Stevens A-35 water-stage recorder
? - present	McGregor, Iowa (mile 633.4)	Staff gage
? - present	McGregor, Iowa (mile 633.4)	Enameled staff gage
1965? - present	McGregor, Iowa (mile 633.4) and tailwater of Lock and Dam No. 9 (mile 647.5)	Fisher-Porter automatic digital recorders

Laboratory sample analysis

Suspended-sediment concentration are being run on all samples collected at this station by the USGS Sedimentation Laboratory at Iowa City, Iowa. Particle-size analyses are run on selected samples. These procedures are outlined in Reference 1b.

Data reduction procedures

Sediment load is computed using the suspended-sediment concentration values obtained at this station and the discharge data from the McGregor, Iowa, gaging station. The USGS Water Resources Division load computer program W-4252 is used to determine the load. Reference 1c provides a detailed account of the data reduction procedures.

Data reporting procedures

All discharge data prior to 1961 were published annually in Reference 16. Since 1961, the discharge data have been published in References 34, 35, and 36. These data will also be entered in WATSTORE, an automated information and retrieval program operated by the USGS. Suspended-sediment concentration and load data will be published in Reference 14 when the data for water year 1976 are published.

General information

Although this station has only a short-term sediment record, it will continue to operate for a long time. It should provide useful

data on the sediment load in this reach of the Mississippi River.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

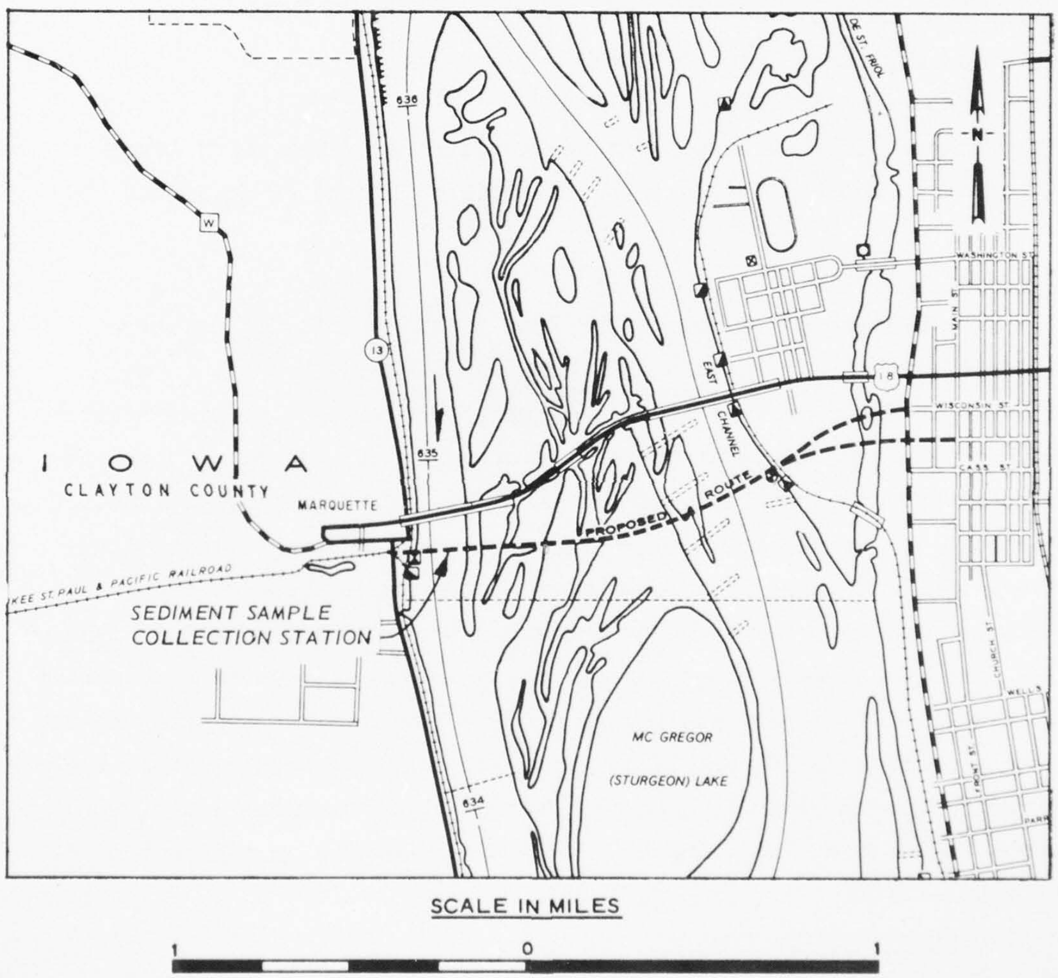
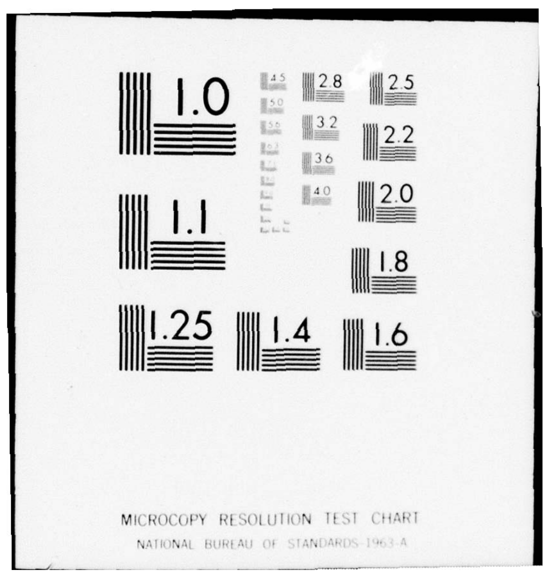


Figure A81. Site location for McGregor, Iowa, sediment sample collection station (Source: Chart 118, Upper Mississippi River Navigation Charts, U. S. Army Engineer Division, North Central, Chicago, Illinois, 1972)

AD-A039 571 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 8/8
INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISS--ETC(U)
MAR 77 M P KEOWN, E A DARDEAU, J G KENNEDY
UNCLASSIFIED WES-TR-M-77-1 NL

4 OF 6
ADA039 571


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Mississippi River at Winona, Minnesota

Station identification

OWDC No.: 57083

Agency station No.: 05378500

Latitude/longitude: 440320/913815

Agency reporting to OWDC: USGS

River mile: 725.7 (Mile 0 is at the confluence of the Mississippi and the Ohio rivers; established by the CE in 1930.)

Site description

The station is on the center span of the Burlington Northern Railroad bridge, 2.7 miles downstream from Lock and Dam No. 5A at Winona, Minnesota (Figure A82). Between the sediment sampling station and Lock and Dam No. 5A are series of submerged wing dams on both the left (Wisconsin) and right (Minnesota) banks of the river. In addition, there are four small marinas, a commercial dock, a recreational site with a boat ramp, and a limited amount of submerged bank protection. The streambed material is sand, and the channel gradient is 0.6 ft/mile.

The discharge at low and median stages is affected to some extent by regulation from navigation dams and power plants. Flood flow is not materially affected by artificial storage. The discharges during the period of record (June 1928 to the present) are: maximum - 268,000 cfs; mean - 26,120 cfs; and minimum - 2,520 cfs. No data on sediment loads are available.

Station chronological record

This station, a long-term water-quality station, was established as a sediment sample collection station by the USGS under the National Stream Quality Accounting Network (NASQUAN) program in October 1974. Monthly suspended-sediment samples were taken in conjunction with chemical water-quality samples.

In September 1975, the station was converted to a daily sediment sample collection station under Great I River Study, Sediment and Erosion Program. The purpose of the study is to monitor rates of sedimentation

and erosion within the river corridor. The USGS Minnesota District is responsible for sample collection, data reduction, and data publication. The USGS Sedimentation Laboratory at Iowa City, Iowa, handles analysis of sediment samples.

Sample and data collection procedures

Daily depth-integrated suspended-sediment samples are taken by a paid observer during the open-water period and on a weekly basis during the winter months (December, January, February). A depth-integrated suspended sediment sampler, US D-49, is used for sampling. The 62-lb sampler is suspended by cable-and-reel, which is attached to the sediment shelter on the railroad bridge. The USGS personnel make suspended-sediment measurements using equal-discharge-increment methods to establish a coefficient to be applied to the observer's single sample (Reference 1a).

A Helley-Smith bed-load sampler is used to determine the bed load. The sampler with sediment trap bag is lowered to the bed of the channel and left there for 2 min or longer, depending on the flow conditions, to collect a bed-load sample. This is repeated at 10 to 20 points along the stream cross section. From the amount of material trapped in the bag, a rate of bed-load transport is determined as described under "Data reduction procedures."

Several agencies have collected gage-height data in the vicinity of Winona since 1878. Discharge records date to June 1928, and since 31 March 1937, discharges have been computed using gage-height differences of this (base) gage and an auxiliary gage in the tailwater of Lock and Dam No. 5A (mile 728.4). The tabulation below lists the gaging and recording devices used at Winona and Lock and Dam No. 5A since the beginning of the period of record and the agencies responsible for collecting these data.

Period	Locality	Device Used
	Mississippi River Commission	
1878 - 1919?	Winona (mile 725.9)	Nonrecording gage

Period	Locality	Device Used
	U. S. Weather Bureau (now National Weather Service)	
4 April 1919 - 1928?	Winona (mile 725.9)	Nonrecording gage
	USGS	
10 June 1928 - 15 April 1931	Winona (mile 725.9)	Nonrecording gage
16 April 1931 - 12 November 1934	Winona (mile 725.7)	Nonrecording gage
13 November 1934 - present	Winona (mile 725.7)	Friez continuous water-stage recorder later replaced by a Stevens A-35 recorder (about 1955)
31 March 1937 - present	Lock and Dam No. 5A (mile 728.4)	Freiz continuous water-stage recorder later replaced by a Stevens A-35 recorder (about 1955)
1972? - present	Winona (mile 725.7) and Lock and Dam No. 5A (mile 728.4)	Fisher-Porter automatic digital recorders
	CE St. Paul District	
1937? - present	Lock and Dam No. 5A (mile 728.4)	Stevens A-35 water-stage recorder

Laboratory sample analysis

Samples are analyzed to determine suspended-sediment concentration and particle-size distribution by the USGS laboratory in Iowa City, Iowa (Reference 1b).

Data production procedures

Sediment data are reduced by the Basic Data Section, Water Resources Division, USGS, St. Paul, Minnesota. Computations of suspended-sediment load are made using flow data and the concentration data in accordance with the procedures outlined in Reference 1c. Bed load (tons per day) is computed as follows:

$$BL = \frac{BLS \times CBW \times 24}{2000}$$

where

BL = bed load (tons/day)

BLS = bed-load sediment (pounds) per hour per foot of channel bottom width

CBW = total width of channel bottom (ft)

24 = conversion from hours to days

2000 = conversion from pounds to tons

Therefore,

$$TSD = BL + SL$$

where

TSD = total sediment discharge (tons/day)

SL = suspended-sediment load (tons/day)

Data reporting procedures

Sediment and discharge data are reported by the Basic Data Section, Water Resources Division, USGS, St. Paul, Minnesota, and will be published in Reference 37. A sample of these data for this station is not available.

When the data are available, separate headings will be provided for suspended sediment, bed load, and total sediment discharge on a daily basis. In addition, the data will be stored in the National Water Data Storage and Retrieval System (WATSTORE) and the Environmental Protection Agency's STORET System.

Discharge data for this station are also published in References 35 and 36.

General information

Although this station has only a short-term sediment record, it will continue to operate for a long time as part of the NASQUAN and Great River I Study Programs. It should provide useful data on the sediment loads in this reach of the Mississippi River.

Information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, ATTN: Basic Data Section, Room 1033, Post Office Building, St. Paul, Minnesota 55101.

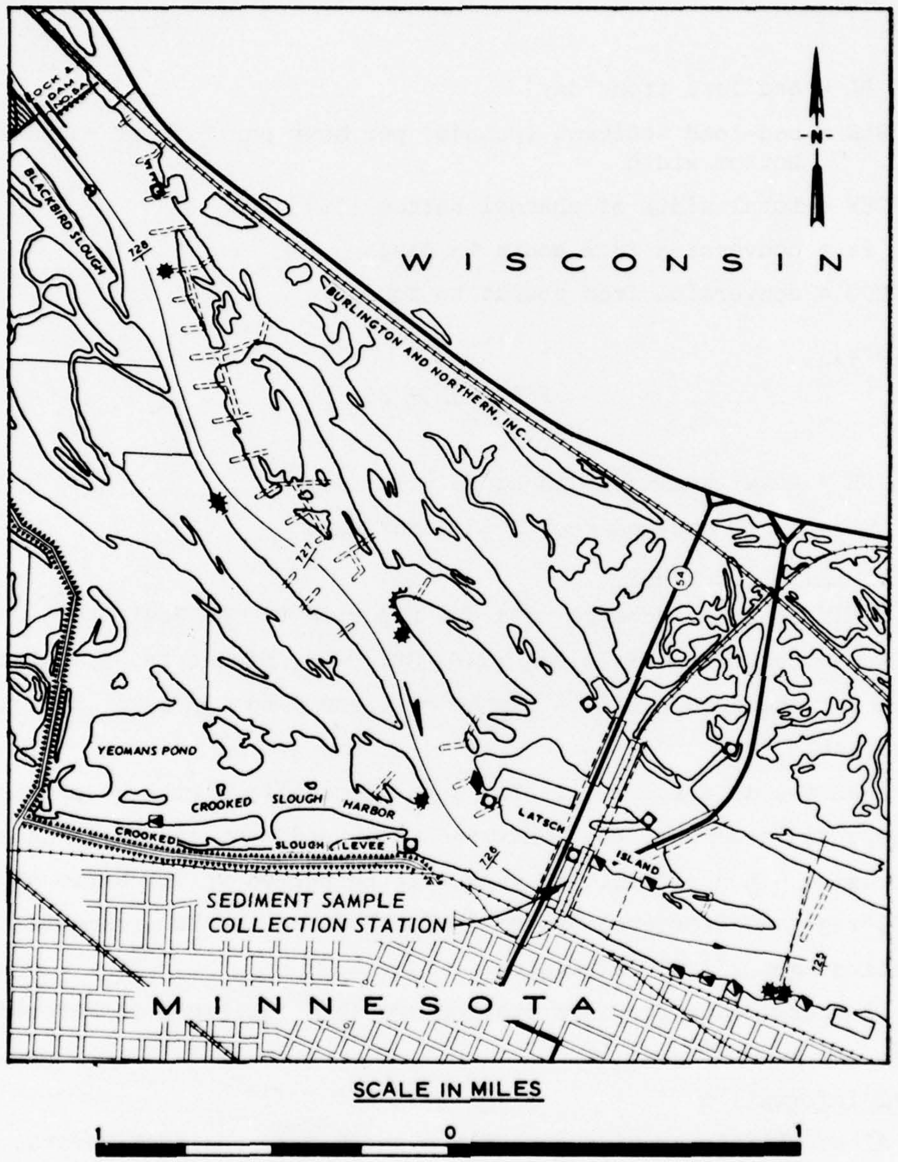


Figure A82. Site location for Winona, Minnesota, sediment sample collection station (Source: Chart No. 136, Upper Mississippi River Navigation Charts, U. S. Army Engineer Division, North Central, Chicago, Illinois, 1972)

Missouri River at Hermann, Missouri

Station identification

OWDC No.: CE, 54659; USGS, 66939

Agency station No.: CE, 11; USGS, 06934500

Latitude/longitude: 384236/912621

Agency reporting to OWDC: CE; USGS

River mile: 97.9 (Mile 0 at the confluence of the Missouri and Mississippi rivers; miles 0-498.4 established by the CE in 1960, and upstream from mile 498.4 established by the CE in 1972.)

Site description

The sediment sample collection and gaging stations at Hermann, Missouri, are at mile 97.9 on the Missouri State Highway 19 Bridge (Figure A83). The left bank is a fertile floodplain that is cultivated extensively. Along the right bank is a 70-ft-high limestone bluff; the area above this bluff line is rocky and topographically unsuited for agricultural activities. Protecting both banks are series of spur dikes at various angles spaced approximately 500 ft apart. These dikes are built of limestone riprap and are 30 ft wide at the base. Between mile 100.0 and mile 101.0 along the left bank is riprap revetment. There is a significant amount of barge traffic in this reach of the river. The nearest downstream docks are at mile 97.8 and mile 96.9, and the nearest upstream docks are at the mouth of the Gasconade River (mile 104.7) and at Chamois, Missouri (mile 117.1). River industry is limited principally to loading facilities for sand, gravel, and fuels.

The streambed material consists of sand, and the approximate channel gradient in this reach of the Missouri River is 0.9 ft/mile. Flow has been partially controlled by Gavins Point Dam since July 1955. The natural streamflow and sediment loads are also affected by numerous Kansas River Basin diversions (for irrigation) and control structures, the majority of which became operational between 1962 and 1969. The tabulation below summarizes the discharges and suspended-sediment loads for

this station for three periods: (a) beginnings of periods of record-1955 (period prior to control by Gavins Point Dam); (b) 1956-1969 (transitional period of construction of Gavins Point Dam and the various Kansas River Basin control structures); and (c) 1970-present (period since the Kansas River Basin control structures became operational):

Period	Maximum	Mean	Minimum
	Discharge, cfs		
1897 - 1955	676,000	79,500	11,000
1956 - 1969	401,000	70,800	6,210
1970 - present	489,000	119,100	16,500
	Suspended-Sediment Load, tons/day		
1949 - 1955	8,340,000	663,200	10,120
1956 - 1969	4,547,000	270,100	503
1970 - present	2,970,331	275,100	3,118

Station chronological record

This station was established by the CE Kansas City District (KCD) on 19 August 1948 to monitor changes in sediment loads in the reach of the Missouri River prior to, during, and after construction of the various upstream dams. In October 1974 this station was made a part of the National Stream Quality Accounting Network (NASQUAN). Sample collection was the responsibility of the KCD prior to 1958, and since that date, the samples have been taken by personnel of the USGS Missouri District. Sample laboratory analysis was handled by the KCD Laboratory from the beginning of the period of record through May 1973; since May 1973 the CE Missouri River Division (MRD) Laboratory in Omaha has analyzed the sediment samples. Data reduction and data publication have been the responsibility of the KCD throughout the period of record.

Sample and data collection procedures

Five depth-integrated vertical samples are taken at least once a week. The sampler is mounted on a mobile crane. The spacings between the verticals are computed from discharge measurements taken prior to sampling by the USGS. The verticals pass through centroids of areas

that pass an equal discharge (the equal-discharge-rate method, see Reference 1a). During periods of high flow, as many as two or three samples a week are taken. The KCD personnel collected the suspended-sediment samples from 4 June 1948 to 1953 with a US P-46 sampler and from 1953 to 1960 with a US D-49 sampler. During the winter periods prior to 1960, where ice interfered with the sample collection, some surface grab samples were taken in place of the depth-integrated verticals. In 1960, the USGS Missouri District personnel assumed responsibility for sampling and continued to use the US D-49 sampler until 1967. Since 1967, the US P-61A1 sampler has been used to collect one-way (descending trip only) depth-integrated vertical samples. In 1972, the US P-61A1 sampler was fitted with an adapter for quart-size plastic bottles. In addition, since October 1972, the USGS has been using the US P-61A1 sampler to collect monthly point-integrated verticals with five to seven points per vertical for particle-size analysis; bed-material samples are taken at each vertical with a US BM-54 sampler. These samplers are discussed in Reference 1a. Since 1963, temperatures of the samples have been measured. Collection of monthly samples for analysis of chemical and biological constituents began in October 1969; pesticide sampling began in October 1970.

The gaging station at Hermann was established on 24 April 1873 at mile 97.9. The following tabulation lists the gaging and recording devices in use at Hermann during the periods of record and the agencies responsible for collecting the data:

Period	Device Used
	CE
24 April 1873 - 31 December 1899	Inclined staff gage
	U. S. Weather Bureau (now National Weather Service)
1 January 1900 - 25 September 1930	Inclined staff gage (CE property)
26 September 1930 - present	Canfield wire-weight gage

(Continued)

Period	Device Used
	U. S. Weather Bureau (now National Weather Service) (Continued)
30 January 1968 - present	Stevens Type T-4 Telemark gage (driven by manometer)
	USGS
17 August 1928 - 25 September 1930	Inclined staff gage (CE property)
26 September 1930 - 27 March 1932	Canfield wire-weight gage (Weather Bureau property)
28 March 1932 - present	Stevens A-35 recorder
21 December 1967 - present	Fisher-Porter automatic digital recorder (driven by manometer)

Laboratory sample analysis

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Suspended-sediment data are published in Reference 11. Figure A84 is an example of these data. Discharge data were published in Reference 12 from the beginning of the period of record through 1970 and in Reference 32 from 1961 to the present. Water-quality data have been published in Reference 18 from 1970 to the present.

General information

The discharge record for Hermann is considered good; the sediment record for years prior to 1967 is considered fair, and after that date it is regarded as good. Further information on this station can be obtained from: U. S. Army Engineer District, Kansas City, Water Control Section, Hydrologic Engineering Branch, Engineering Division, 601 East 12th Street, Room 844, Kansas City, Missouri 64106; or U. S. Department of the Interior, Geological Survey, Water Resources Division, P. O. Box 340, 103 West Tenth Street, Rolla, Missouri 65401.

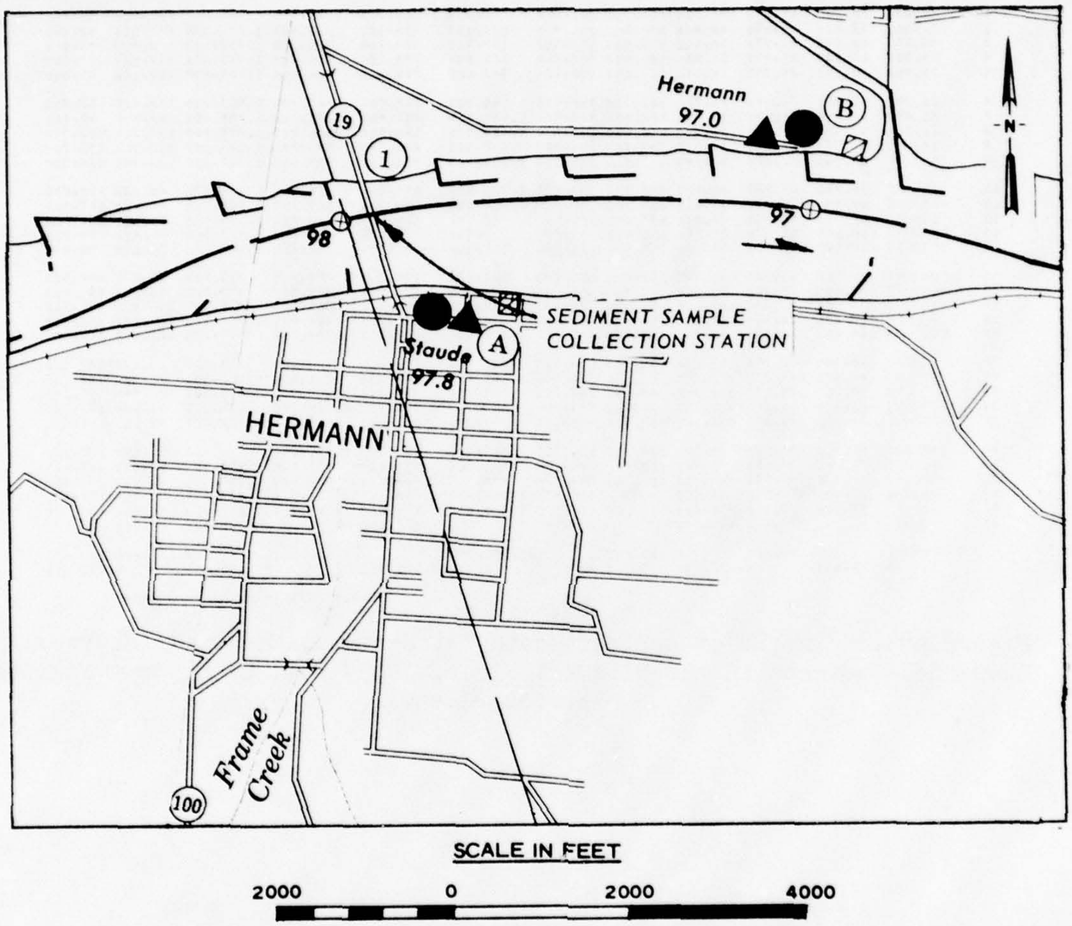


Figure A83. Site location for Hermann, Missouri, sediment sample collection station (Source: Charts Nos. 3 and 4, Missouri River Navigation Charts, Kansas City, Missouri, to the Mouth, U. S. Army Engineer Division, Missouri River, Omaha, Nebraska, 1973)

MISSOURI RIVER AT HERMANN, MISSOURI

SUSPENDED SEDIMENT LOAD - TONS

WATER YEAR OCT 1968 - SEP 1969

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	34,630	76,520	81,350	194,600	316,300	353,600	272,200	1,229,000	263,500	895,200	230,500	43,740
2	34,850	73,570	70,850	148,800	274,800	261,400	235,200	864,000	401,800	1,378,000	197,000	42,050
3	34,850	66,940	81,770	106,500	236,500	178,500	187,900	564,700	465,100	1,857,000	176,700	42,590
4	36,380	66,820	81,220	81,850	185,800	207,800	161,800	391,100	386,300	1,995,000	150,100	47,250
5	33,900	68,040	74,390	58,690	123,100	238,800	342,600	281,000	306,600	1,969,000	162,100	49,680
6	33,390	82,350	73,440	41,770	100,300	264,500	1,160,000	227,800	267,800	1,863,000	180,200	52,310
7	33,680	95,410	71,060	35,940	122,400	264,400	1,820,000	201,400	231,300	1,546,000	159,700	55,460
8	33,390	92,520	71,830	31,300	210,500	257,600	1,803,000	180,800	180,800	1,348,000	132,200	62,370
9	36960	87,770	66,440	32,570	352,900	224,500	1,608,000	262,200	143,400	1,254,000	119,500	242,700
10	44230	83,960	62,990	37,040	343,600	189,100	1,383,000	450,200	125,500	1,318,000	103,700	326,500
11	64400	78,210	62,230	41,600	273,800	155,900	1,202,000	644,200	126,600	1,444,000	88,030	234,000
12	110700	76,140	53,450	37,610	219,200	125,300	1,026,000	746,500	109,500	1,554,000	78,080	167,400
13	189900	87,480	46,020	30,300	177,000	100,800	902,900	784,500	102,600	1,535,000	78,980	119,500
14	387800	102,000	41,520	31,280	141,600	84,700	772,400	563,300	101,200	1,402,000	75,420	94,620
15	291600	125,900	38,100	48,380	114,800	72,730	711,300	351,500	243,200	1,163,000	73,390	80,540
16	189200	221,800	33,060	61,550	85,820	61,740	633,700	239,800	388,800	810,800	72,770	148,500
17	147200	280,100	28,590	92,730	62,460	51,780	734,300	176,200	359,900	573,800	73,240	653,900
18	119000	253,600	31,350	135,300	51,230	50,970	1,179,000	147,300	289,200	411,300	135,800	560,200
19	90070	213,800	29,970	147,900	56,570	60,940	1,660,000	121,700	314,000	306,200	167,900	440,900
20	511700	188,100	28,840	156,200	69,120	69,410	1,678,000	132,300	284,100	387,100	121,200	336,000
21	1304000	166,700	28,590	195,800	76,510	118,800	1,307,000	159,000	223,200	718,200	89,640	247,100
22	704000	147,400	44,630	212,700	81,720	255,900	1,102,000	203,300	411,900	1,033,000	70,020	214,100
23	407800	126,200	75,170	206,300	94,600	267,300	801,500	321,300	1,118,000	868,300	63,890	197,200
24	273200	106,400	62,930	220,300	98,850	264,900	613,900	699,200	1,738,000	670,200	61,690	197,000
25	187800	94,590	49,970	156,100	101,300	484,100	497,700	883,200	1,810,000	570,200	59,010	260,700
26	143,400	82,900	36,080	99,560	104,900	670,700	416,100	763,000	1,179,000	490,500	55,650	376,200
27	111,800	75,760	29,550	62,530	106,700	775,200	331,300	654,800	807,800	418,500	57,160	308,400
28	89,260	68,630	87,770	43,210	106,700	774,000	436,500	518,900	536,800	356,500	53,680	218,600
29	74,360	60,940	113,500	64,100		602,600	904,400	350,900	410,700	308,600	51,760	172,800
30	63,180	55,080	219,400	255,700		468,200	1,103,000	255,200	317,500	261,600	48,440	139,700
31	55,350		273,800	499,500		371,500		197,100		224,600	49,840	
	5871980	3,405,630	2,149,860	3,567,710	4,289,080	8,327,670	26,986,700	13,565,400	13,646,100	30,930,600	3,237,290	6,132,010

YEARLY TOTAL = 122110030 TONS

Figure A84. Example of sediment data for Hermann, Missouri (Source: Suspended-Sediment in the Missouri River, 1965-1969, U. S. Army Engineer District, Omaha)

Missouri River at Kansas City, Missouri

Station identification

OWDC No.: 54661

Agency station No.: 36

Latitude/longitude: 390643/943516

Agency reporting to OWDC: CE

River mile: 366.1 (Mile 0 is at the confluence of the Missouri and Mississippi rivers; miles 0-498.4 established by the CE in 1960, and upstream from mile 498.4 established by the CE in 1972.)

Site description

The sediment sample collection station is at mile 365.5 on the Armour-Swift-Burlington highway and railway bridge, 1.1 miles downstream from the Kansas-Missouri State line, and 2 miles downstream from the confluence of the Kansas and Missouri rivers. The gaging station is upstream from the sampling station (mile 366.1) on the downstream side of the right pier of the Hannibal railroad bridge (Chicago, Burlington, and Quincy Railroad). Both locations are shown in Figure A85. Along the left bank is a series of dikes (some submerged) at various orientations. Artificial levees parallel the left bank. The right bank is protected by a combination of artificial levees and floodwalls (along the Kansas City, Missouri, waterfront). Upstream from the sampling and gaging stations is a signification amount of commercial and industrial activity on both banks of the Kansas and Missouri rivers, including commercial docks (associated with agricultural, petroleum, and manufacturing interests, stockyards, and numerous arteries. The streambed material consists of sands, and the approximate channel gradient in this reach of the Missouri River is 0.9 ft/mile. Flow has been partially controlled by Gavins Point Dam since July 1955. The natural streamflow and sediment loads are also affected by numerous Kansas River Basin diversions (for irrigation) and control structures, the majority of which became operational between 1962 and 1969. The tabulation below

summarizes daily discharges and suspended-sediment loads for this station for three periods: (a) beginnings of periods of record-1955 (period prior to control by Gavins Point Dam); (b) 1956-1969 (transitional period of construction of Gavins Point Dam and of the various Kansas River Basin control structures; and (c) 1970-present (period since Kansas River Basin control structures became operational:

Period	Maximum	Mean	Minimum
	Discharge, cfs		
1897-1955	573,000	55,300	1,500
1956-1969	253,000	46,600	4,730
1970-present	307,000	61,300	8,020
	Suspended-Sediment Load, tons/day		
1948-1955	13,163,000	679,500	1,515
1956-1969	6,238,000	213,500	319
1970-present	4,216,519	242,200	362

Station chronological record

This station was established by the CE Kansas City District (KCD) on 14 May 1948 to monitor changes in sediment loads in this reach of the Missouri River prior to, during, and after construction of the various upstream dams. Sample collection was the responsibility of the KCD prior to 1968, and since that date, the samples have been taken by personnel of the USGS Missouri District. Sample laboratory analysis was handled by the KCD Laboratory from the beginning of the period of record through May 1973; since May 1973, the CE Missouri River Division Laboratory in Omaha has analyzed the sediment samples. Data reduction and data publication have been the responsibility of the KCD throughout the period of record.

Sample and data collection procedures

Information regarding the collection of sediment samples is identical to that presented for the Missouri River sediment sample collection station at Hermann, Missouri. Since 1963, temperatures of the samples have been measured. No analysis of samples for chemical and biological constituents and pesticides have ever been made. The gaging

station at Kansas City was established on 21 April 1873 at mile 365.9, at the foot of Delaware Street. On 5 January 1879, it was moved to its present location, the Hannibal railroad bridge, mile 366.1. The following tabulation presents the gaging and recording devices in use at Kansas City during the period of record and the agencies responsible for collecting these data:

Period	Device Used
	CE
21 April 1873 - 4 January 1879	Staff gage*
5 January 1879 - 15 January 1886	Staff gage
15 January 1886 - 31 December 1899	Wire-weight gage
	U. S. Weather Bureau (now National Weather Service)
1 January 1900 - 19 November 1928	Wire-weight gage (CE property)
20 November 1928 - 22 June 1932	Chain gage
22 June 1932 -	Canfield wire-weight gage
1967 (?)-present	Stevens Type T-4 Telemark gage (driven by manometer)
	USGS
19 November 1928 - 4 May 1931	Chain gage (Weather Bureau property)
4 May 1931 - 15 May 1947 (destroyed by flood)	Stevens A-30 recorder (driven by float)
15 May 1947 - 28 February 1948	Canfield wire-weight gage (Weather Bureau property)
28 February 1948 - 4 January 1965	Friez water-stage recorder
4 January 1965 - present	Stevens A-35 recorder (driven by manometer)
1965 (?) - present	Fisher-Porter automatic digital recorder (driven by manometer)

* Mile 365.9; all other gaging and recording devices located at mile 366.1.

Laboratory sample analysis

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek, Kansas.

Data reduction procedures

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek, Kansas.

Data reporting procedures

Information is identical to that presented for the Missouri River sediment sample collection station at Hermann, Missouri, except that Figure A86 is an example of Kansas City, Missouri, data.

General information

The sediment and discharge records for Kansas City are considered good. Further information on this station may be obtained from: U. S. Army Engineer District, Kansas City, Water Control Section, Hydrologic Engineering Branch, Engineering Division, 601 East 12th Street, Room 844, Kansas City, Missouri 64106.

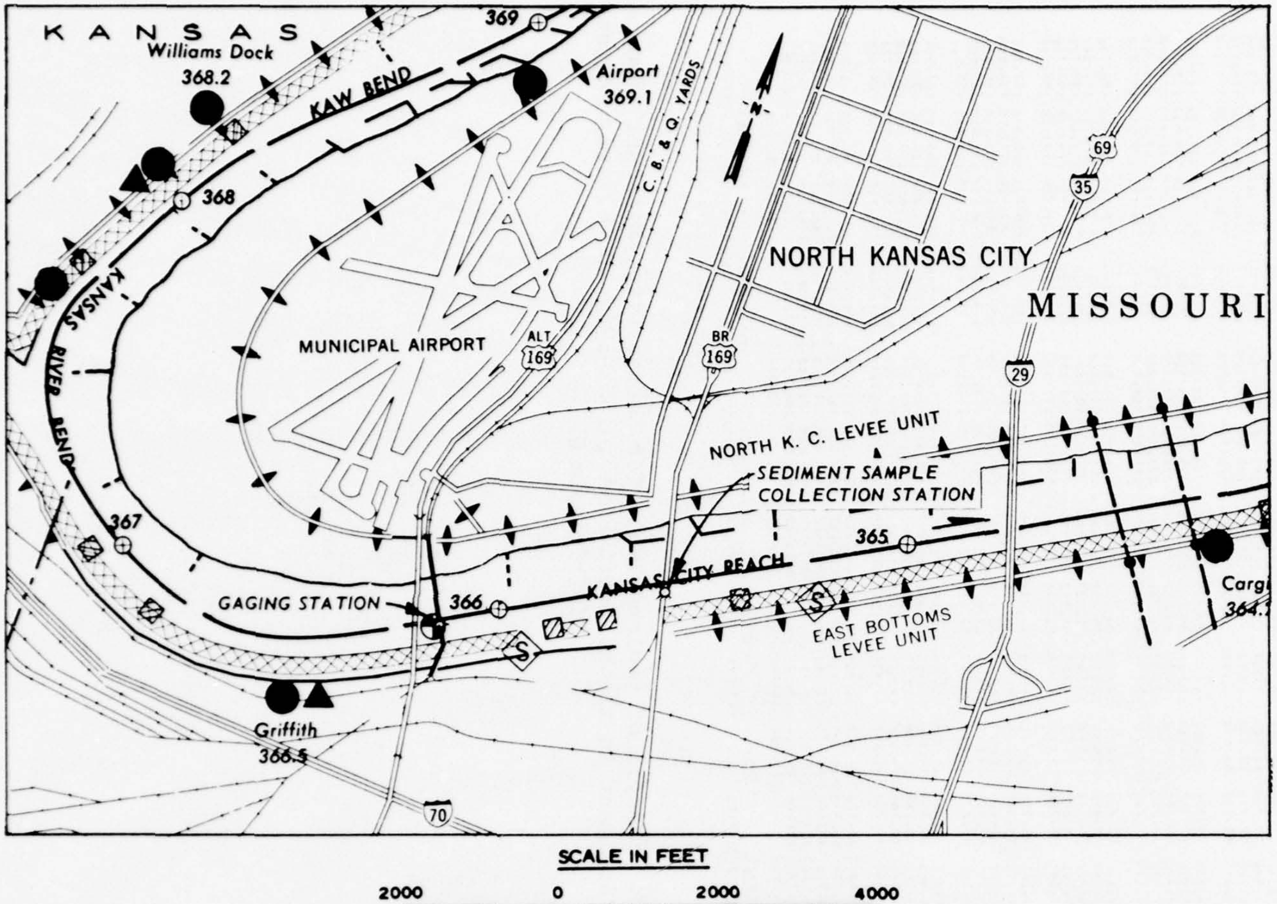


Figure A85. Site location for Kansas City, Missouri, sediment sample collection station (Source: Chart No. 70, Missouri River Navigation Charts, Sioux City, Iowa, to Kansas City, Missouri, U. S. Army Engineer Division, Missouri River, Omaha, Nebraska, 1973)

MISSOURI RIVER AT KANSAS CITY, MISSOURI

SUSPENDED SEDIMENT LOAD - TONS

WATER YEAR OCT 1968 - SEP 1969

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	56,720	64,970	61,520	14,090	17,280	154,600	265,800	450,000	226,500	1,270,000	166,200	106,700
2	57,140	61,830	61,690	9,590	17,040	174,200	175,600	335,600	183,700	1,353,000	154,300	124,100
3	57,840	57,950	61,040	6,426	15,800	213,900	183,600	242,800	154,000	1,142,000	151,900	122,300
4	56,720	57,410	57,750	6472	15,800	241,300	316,900	196,000	133,900	716,500	149,900	116,800
5	57,140	60,210	58,500	9148	15,920	256,200	475,400	180,600	121,700	455,800	140,500	144,900
6	66,130	62,620	58,500	14260	31,090	248,200	496,100	175,100	106,200	314,800	131,500	183,600
7	58,970	63,970	56,980	18620	68,380	220,000	420,600	276,000	90,900	365,300	129,500	224,200
8	59,390	66,190	50920	20900	85,150	169,600	372,800	437,300	87,480	362,900	126,800	222,800
9	67,670	67,890	43120	20050	88,260	120,500	323,700	566,200	93,880	406,300	123,200	204,900
10	123,100	71,220	37420	17010	87,320	91,340	289,200	469,800	96,830	531,200	120,500	187,900
11	122,100	76,730	31910	14130	83,350	72,770	300,500	330,800	106,200	631,800	119,600	180,700
12	96,240	77,990	25510	12190	75,690	60,460	326,600	251,400	126,600	547,600	119,100	175,000
13	80,330	76,730	23880	11390	67,230	53,160	357,000	178,800	171,100	419,900	110,100	163,700
14	68,720	74,090	20570	12360	58,950	49,110	391,200	148,900	220,500	364,900	104,700	153,700
15	66,640	78,260	17390	14240	52,050	49,110	456,200	133,000	202,200	279,700	122,300	148,100
16	56,280	75,820	14180	21020	44,460	49,690	560,000	123,200	146,600	206,200	130,800	146,300
17	69,370	73,480	12080	29050	38,300	49,920	734,900	152,800	119,100	165,800	124,100	142,800
18	1,117,000	70,120	10940	36730	38,300	86,410	689,300	214,500	126,900	199,500	109,900	140,000
19	845,000	68,370	14740	44100	38,300	197,800	550,300	249,900	149,500	478,000	101,500	135,600
20	509,200	69,220	60030	46310	37,970	262,000	432,200	233,100	152,300	495,700	100,800	133,900
21	329,800	68,300	66,420	45900	41,160	221,000	335,400	256,200	194,800	396,600	103,100	133,900
22	238,500	67,470	46,940	46820	48,350	181,100	278,400	536,700	369,700	325,900	109,000	133,100
23	170,900	63,180	34,450	47250	57,320	159,800	249,200	780,400	508,900	231,500	105,800	133,900
24	139,300	62,780	25,570	43130	79,230	214,300	230,200	702,000	546,900	202,800	100,900	138,200
25	120,900	61,700	21,250	38,830	116,500	397,400	208,600	631,300	327,500	232,900	95,630	144,600
26	107,900	62,100	20,910	34,020	133,400	473,700	241,400	561,300	405,700	266,300	90,730	136,500
27	98,230	63,990	24,660	27,480	209,000	412,000	1,247,000	465,200	1,176,000	255,400	87,030	119,600
28	93,310	63,180	26,570	23,060	192,800	351,900	2,963,000	379,800	1,877,000	248,000	84,240	105,800
29	85,150	61,290	29,480	21,290		347,500	1,459,000	323,600	1,415,000	244,300	83,160	94,310
30	75,790	62,100	29,800	19,600		335,200	664,500	269,200	971,200	230,600	81,000	83,710
31	69,050		20,980	18,980		329,900		236,600		195,700	91,720	
	5,214,530	2,011,160	1125700	744466	1,854,400	6,244,070	15,996,600	10,488,100	10,614,790	13,536,900	3,569,510	4,381,620

YEARLY TOTAL - 75781846 TONS

Figure A86. Example of sediment data for Kansas City, Missouri (Source: Suspended Sediment in the Missouri River, 1965-1969, U. S. Army Engineer District, Omaha)

Missouri River at St. Joseph, Missouri

Station identification

OWDC No.: CE, 54662; USGS, 66928

Agency station No.: CE, 44; USGS, 06818000

Latitude/longitude: 394510/945128

Agency reporting to OWDC: CE; USGS

River mile: 447.9 (Mile 0 is at the confluence of the Missouri and Mississippi rivers; miles 0-498.4 established by the CE in 1960, and upstream from mile 498.4 established by the CE in 1972.)

Site description

The sediment sample collection station is at mile 447.9 on the U. S. Highway 36 Bridge linking St. Joseph with Elwood, Kansas. The St. Joseph stream-gaging station is at mile 448.2 on the left abutment of the St. Joseph and Grand Island Railroad bridge (Figure A87). Both the right (or Kansas) bank and the left (or Missouri) bank are protected with a combination of dikes and revetment (riprap). An artificial levee parallels the entire right bank along this reach. There is an artificial levee along the left bank upstream from the sediment and gaging stations above mile 450.4. There are several commercial docks serving the barge traffic in the vicinity of St. Joseph urban-industrial area (all along the left bank), but the majority of these are downstream from the sediment and gaging stations. The right bank is less industrialized than the left, and the land is used primarily for agriculture (principally grains). The streambed material consists of sands, and the approximate channel gradient in this reach is 1 ft/mile. Flow has been partially controlled by Gavins Point Dam since July 1955. The discharges of record from August 1928 to July 1955 are: maximum - 397,000 cfs; mean - 37,000 cfs; and minimum - 2,300 cfs. From July 1955 to the present, the discharges of record are: maximum - 200,000 cfs; mean - 42,000 cfs; and minimum - 4,000 cfs. The daily suspended sediment loads measured from June 1948 to July 1955 are: maximum - 7,131,000 tons/day;

mean - 554,000 tons/day; and minimum - 1,990 tons/day. From July 1955 to the present, the sediment loads of record are: maximum - 4,300,000 tons/day; mean - 157,000 tons/day; and minimum - 216 tons/day.

Station chronological record

This station was established by the CE Kansas City District (KCD) on June 1948 to monitor changes in sediment loads in this reach of the Missouri River prior to, during, and after construction of the various upstream dams. In October 1973, this station was made a part of the National Stream Quality Accounting Network (NASQUAN) by the USGS Missouri District. Sample collection at the CE station was the responsibility of the KCD prior to 1960, and since that date, the samples have been taken by personnel from the USGS Missouri District. Sample laboratory analysis for the CE station was handled by the KCD Laboratory from the beginning of the period of record through May 1973; since May 1973, the CE Missouri River Division Laboratory in Omaha has analyzed the sediment samples. Data reduction and data publication for samples taken at the CE station have been the responsibility of the KCD throughout the the period of record. The USGS handles collection and analyses of its samples and reduces and publishes the data (NASQUAN).

Sample and data
collection procedures

Information regarding the collection of sediment samples is identical to that presented for the Missouri River sediment sample collection at Hermann, Missouri.

Since 1963, temperatures have been collected with each suspended-sediment sample. In October 1969, the USGS began collecting monthly samples for chemical analysis at mile 449.1, near the raw-water intake of the St. Joseph Water Company water treatment plant. In August 1972, sample analysis for pesticides was initiated, and in October 1972, biological analyses were begun.

The gaging station at St. Joseph was established on 19 June 1872 at mile 448.2. The tabulation below lists the gaging and recording devices used at St. Joseph as well as their periods of record and the responsible agencies.

Period	Device Used
CE	
19 June 1872 - 30 April 1899	Vertical staff gage
30 April 1899 - 31 December 1899	Wire-weight gage
U. S. Weather Bureau (now National Weather Service)	
1 January 1900 - 22 May 1910	Wire-weight gage
22 May 1910 - 15 March 1933	Chain gage
16 March 1933 - present	Canfield wire-weight gage (USGS property)
1953 - present	Stevens Type-4 Telemark gage (driven by manometer)
USGS	
9 August 1928 - 15 March 1933	Chain gage (Weather Bureau property)
21 October 1931 - 24 March 1934	Stevens A-30 recorder (driven by float)
16 March 1933 - present	Vertical enameled staff gage
16 March 1933 - present	Canfield wire-weight gage
24 March 1934 - 1965(?)	Stevens A-35 recorder
1965(?) - present	Fisher-Porter automatic digital recorder (driven by manometer)

Laboratory sample analysis

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Information is identical to that presented for the Missouri River sediment sample collection station at Hermann, Missouri, except that Figure A88 is an example of St. Joseph, Missouri, data.

General information

The sediment record for St. Joseph is considered fair by the KCD personnel, especially that portion prior to 1967 when samples were

collected with the US D-49 sampler. The KCD personnel believe that the suspended-sediment concentrations are not as high as the laboratory results indicate.

Further information on this station can be obtained from: U. S. Army Engineer District, Kansas City, Water Control Section, Hydrologic Engineering Branch, Engineering Division, 601 E 12th Street, Room 844, Kansas City, Missouri 64106; or U. S. Department of the Interior, Geological Survey, Water Resources Division, P. O. Box 340, 103 West Tenth Street, Rolla, Missouri 65401.

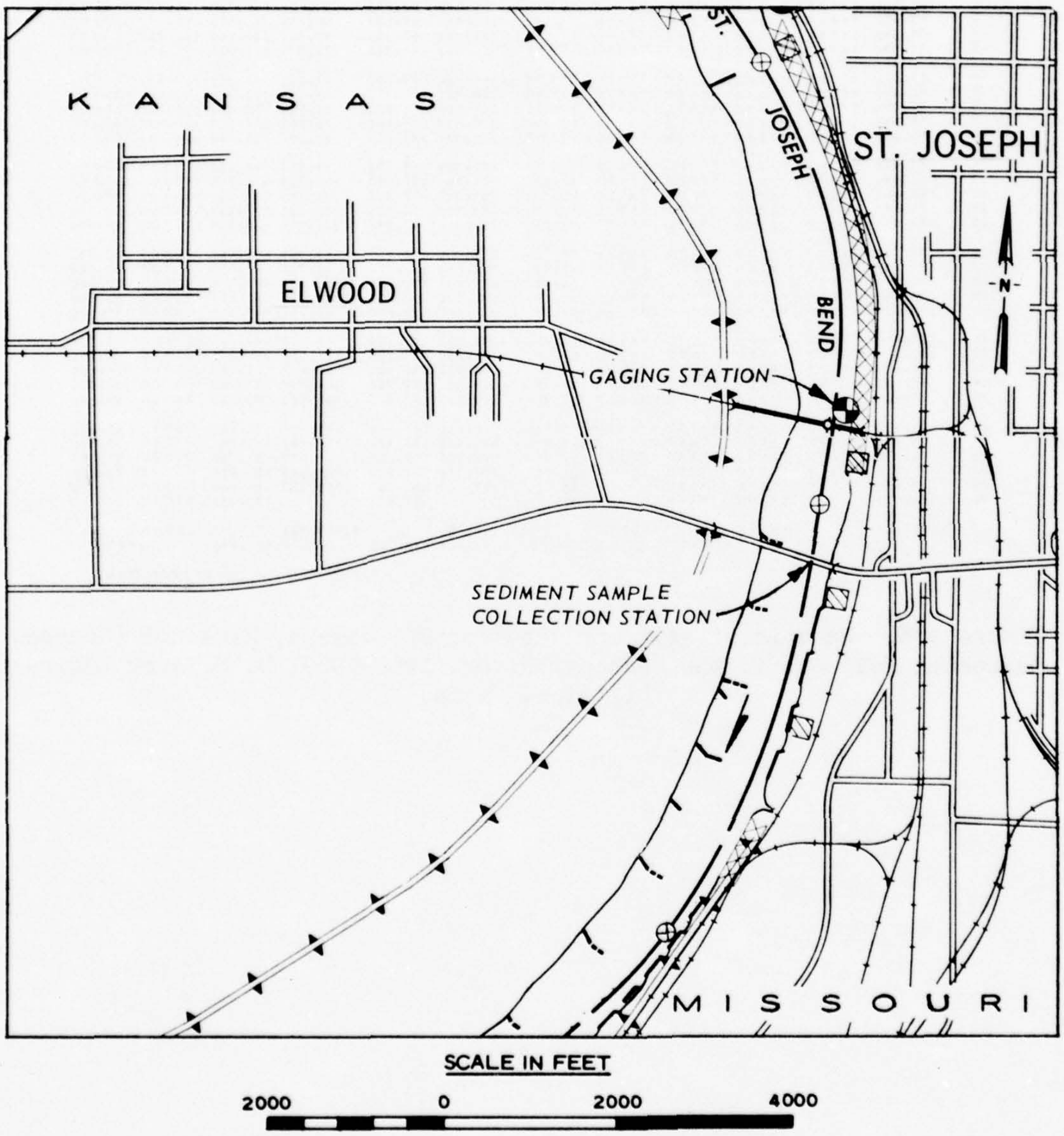


Figure A87. Site location for St. Joseph, Missouri, sediment sample collection station (Source: Charts No. 54 and 55, Missouri River Navigation Charts, Sioux City, Iowa, to Kansas City, Missouri, U. S. Army Engineer Division, Missouri River, Omaha, Nebraska, 1973)

MISSOURI RIVER AT ST JOSEPH, MISSOURI

SUSPENDED SEDIMENT LOAD - TONS

WATER YEAR OCT 1968 - SEP 1969

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	42,770	73520	49360	10990	10150	123100	73,840	106,900	98,770	833,100	85,540	103900
2	44,710	58700	49740	7605	12300	105000	80,640	90,190	94,800	435,400	90,560	119400
3	43,930	47940	53090	5184	12170	96030	123,800	86,020	88,390	223,600	99,480	122800
4	44,190	47630	57420	6172	12420	86650	358,000	85,360	80,810	136,100	100,400	111600
5	47,790	18100	57840	4957	13090	75250	1,090,000	78,210	71,870	121,500	98,770	114100
6	49,010	40490	52790	9207	15510	[illegible]	1,114,000	74,250	64,580	242,100	103,400	128300
7	50,360	47070	45000	12140	19340	[illegible]	926,700	178,900	61,140	321,500	107,500	132100
8	49,350	47070	36740	13050	24890	[illegible]	518,200	461,500	62,900	255,200	111,600	119200
9	46,060	18690	30220	13990	29270	[illegible]	278,400	265,500	70,160	188,600	115,800	113300
10	46,330	53400	24850	21540	33660	51520	260,900	185,900	85,020	256,300	114,100	108300
11	45,380	56160	20910	12080	38610	47950	462,600	144,800	104,900	404,000	122100	105100
12	42,640	55620	17620	10620	38900	47,140	652,500	120,700	130,700	330,500	118400	102400
13	40,180	56160	14600	10620	35720	49,730	756,000	108,300	152,700	236,900	113500	98030
14	38,560	53180	12180	10870	31000	50,220	774,100	97,460	156,600	177,100	110000	92,690
15	37,910	53710	9860	11990	28010	51,890	689,000	91,240	131,500	138,600	109200	86,070
16	38,230	54510	7079	14580	25900	59,710	595,400	86,180	112,300	107,600	107600	82,760
17	127,300	55040	4590	19120	24420	62,650	752,500	102,100	97,760	95,520	105900	82,080
18	201,900	57290	3888	24120	22880	64,460	927,400	114,200	89,600	191,600	100400	82,760
19	190,800	59810	18400	25170	23700	155,800	696,800	109,200	82,330	564,200	98100	82,080
20	153,900	61350	41010	23520	23880	184,700	496,600	99,680	83,010	484,100	96590	79,650
21	124,400	57100	35240	21210	25980	154,400	356,400	95,750	82,330	366,300	103400	79,110
22	101,200	52620	23620	21650	28290	129,300	292,200	409,100	101,900	269,200	107500	78,760
23	97,520	51320	14730	22670	34340	131,300	240,400	291,400	88,860	181,100	106000	74,130
24	80,850	52500	9385	20910	50510	183,400	198,300	186,900	124,000	126,200	101200	72,780
25	68,500	52500	9356	18170	64980	213,300	161,000	139,600	130,000	92,990	96850	69,140
26	60,930	52620	11340	13350	119500	192,600	240,200	116,200	147,400	98,920	93570	68,500
27	54,820	53090	12420	9809	231700	128,500	895,800	109,100	827,400	141,800	91930	74,360
28	51,170	53090	14430	8311	160200	99,710	648,000	105,200	1,878,000	151,700	91030	81,850
29	53,710	50410	15670	8208		101,300	267,700	102,200	1,701,000	120,500	90290	92,020
30	57,150	49360	15820	9180		118,300	157,200	100,800	1,559,000	99,860	88360	105,900
31	63,570		14380	9774		98,100		97,870		90,550	87620	
	2,195,120	1600130	783578	429157	1,192210	3115993	15,084,780	4,440,710	8,559,730	7,482,640	3166690	2863170

YEARLY TOTAL - 50913905 TONS

Figure A88. Example of sediment data for St. Joseph, Missouri (Source: Suspended Sediment in the Missouri River, 1965-1969, U. S. Army Engineer District, Omaha)

Missouri River at Nebraska City, Nebraska

Station identification

OWDC No.: CE, 54736; USGS, 50381

Agency station No.: CE, 951; USGS, 06807000

Latitude/longitude: 404055/955048

Agency reporting to OWDC: CE; USGS

River mile: 561.8 (Mile 0 is at the confluence of the Missouri and Mississippi rivers; miles 0-498.4 established by the CE in 1960, and upstream from mile 498.4 established by the CE in 1972.)

Site description

The station is at the Waubonsie Highway Bridge (Nebraska-Iowa State Highway 2) on a straight reach of the Missouri River at Nebraska City, Nebraska (Figure A89). The streambed consists of sand and gravel, and the gradient of the bed is approximately 0.8 ft/mile. The channel is regulated for navigation and flood control and is not subject to overflow; it is stabilized by revetment and dikes to mile 753.0. Upstream from the station there are dikes on the left bank and revetment on the right bank. There are several docks 0.5 mile upstream on the right bank. The Platte River, which is a major sediment carrier, empties into the Missouri River 33 miles upstream from the site. Flow has been partially controlled by Gavins Point Dam since July 1955. The discharges of record from 1929 through July 1955 are: maximum - 414,000 cfs; and minimum - 1,600 cfs. No mean discharge value is available for the period. From July 1955 to the present, the discharges of record are: maximum - 166,000 cfs; mean - 41,130 cfs; and minimum - 6,421 cfs. The sediment loads of record (1957 to the present) are: maximum - 1,590,000 tons/day; mean - 130,000 tons/day; and minimum - 4,050 tons/day.

Station chronological record

The station was established in 1957 to monitor the sediment contribution of the Platte River to the Missouri River and to continue studies of the degradation of the Missouri River. Operations were

conducted by the Omaha District (OD) until 1 July 1972, when the USGS Iowa District took over under contract to the OD. These operations are detailed in the following tabulation:

Activity	Responsible Agency	Dates
Sample collection	OD	1 August 1957 - 30 June 1972
	USGS Iowa District	1 July 1972 - present
Sample laboratory analysis	Missouri River Division Soils Laboratory	1 August 1957 - 30 June 1972
	USGS Soils Laboratory	1 July 1972 - present
Data reduction	OD	1 August 1957 - 30 June 1972
	USGS Iowa District	1 July 1952 - present
Data publication	OD	1957 - 1969
	CE Kansas City District	1970 - present
	USGS Iowa District*	1 July 1972 - present

* Data are also available from WATSTORE, an automated information retrieval program operated by the USGS.

Sample and data collection procedures

Samples were collected by the OD once every four days from 1 August 1957 to 30 June 1972, with additional samples taken during high flows. The USGS Iowa District began collecting samples on 1 July 1972 each time the discharge was measured, normally twice a week during the navigation season. A Type-E crane is used to lower the current sampling apparatus. Details are tabulated below:

Dates	Type of Sample	Equipment Used	Description or Purpose of Procedure
		OD	
1957-59	Point-and depth-integrated	US P-46 sampler	Samples were taken on 10 verticals.* During the first three weeks of each month, point samples were taken on odd verticals.

(Continued)

* The points on the verticals were determined by Luby tables; the horizontal spacings between verticals were determined by the equal-discharge-rate method. All procedures are described in Reference 1a.

Dates	Type of Sample	Equipment Used	Description or Purpose of Procedure
		OD (Continued)	
			During the fourth week, depth-integrated samples were also taken, two on odd verticals and one on even verticals. (Samples were taken once every four days, regardless of timing by weeks.)
1960-64	Depth-integrated	US P-46 sampler	Depth-integrated samples were taken every four days on odd verticals.
1965-72	Depth-integrated	US P-61 or US P-62 sampler	Depth-integrated samples were taken every four days on odd verticals.
1960-72	Point-integrated	US P-61 or US P-62	Point-integrated samples were taken during the fourth week of each month on even verticals.
1965-72	Bed	US BM-54 sampler	Random samples of bed material were taken.
		USGS Iowa District	
1972-present	Point-integrated	US P-61 sampler	Depth-integrated samples are taken at three verticals along the cross section to comprise a set. Temperature and conductivity are noted for all samples.
1972-present	Bed	US BM-54	Samples of bed material are taken once each month. Temperature and conductivity are noted for all samples.

Gaging in the vicinity of Nebraska City began on 1 August 1878 and has continued since that date, except from 1 January 1900 to November 1917. The tabulation below presents the gaging and recording devices used during the period of record and the agencies responsible for collecting these data:

Period	Locality	Device Used
	OD	
1 August 1878 - 30 October 1888	Downstream from Chicago, Burlington, and Quincy Railroad bridge (mile 561.3)	Inclined masonary gage
31 October 1888 - 31 December 1899	Chicago, Burlington, and Quincy Railroad bridge (mile 561.8)	Cable gage
1963? - present	Right bank upstream from Waubonsie Highway Bridge (mile 562.6)	Telemark gage* driven by USGS manometer
	Chicago, Burlington, and Quincy Railroad	
November 1917 - 12 August 1929	Right bank upstream from Waubonsie Highway Bridge (mile 562.6)	Cable gage
12 August 1929 - 27 June 1930	Right bank upstream from Waubonsie Highway Bridge (mile 562.6)	Chain gage
27 June 1930 - 1 August 1932	Right bank upstream from Waubonsie Highway Bridge (mile 562.6)	Wire-weight gage
22 October 1931 - 1 April 1963	Waubonsie Highway Bridge (mile 561.8)	Recording gage
1 August 1932 - 1963?	Waubonsie Highway Bridge (mile 561.8)	Wire-weight gage
1 April 1963 - present	Right bank upstream from Waubonsie Highway Bridge (mile 562.6)	Stevens A-35 recorder driven by manometer

* Telemark gage is also used by National Weather Service.

Laboratory sample analysis

Information is identical to that presented for the Boyer River (East Fork) sediment sample collection station at Denison, Iowa.

Data reduction procedures

Information is identical to that presented for the Boyer River (East Fork) sediment sample collection station at Denison, Iowa.

Data reporting procedures

Sediment data are published in Reference 11. Figure A90 is an example of these data. Discharge data for the years prior to 1961 were published in Reference 12, and from 1961 to the present, the data have been published in References 15 and 23. Data are also entered on the USGS WATSTORE, an automated retrieval system.

General information

Sediment records for this station are considered to be good. Additional information on this station can be obtained from: U. S. Army Engineer District, Omaha, Hydrologic Engineering Branch, Water Quality and Sediment Section, Federal Building, Omaha, Nebraska 68102; or from the U. S. Department of the Interior, Geological Survey, Iowa District, 400 South Clinton Street, Iowa City, Iowa 52240.

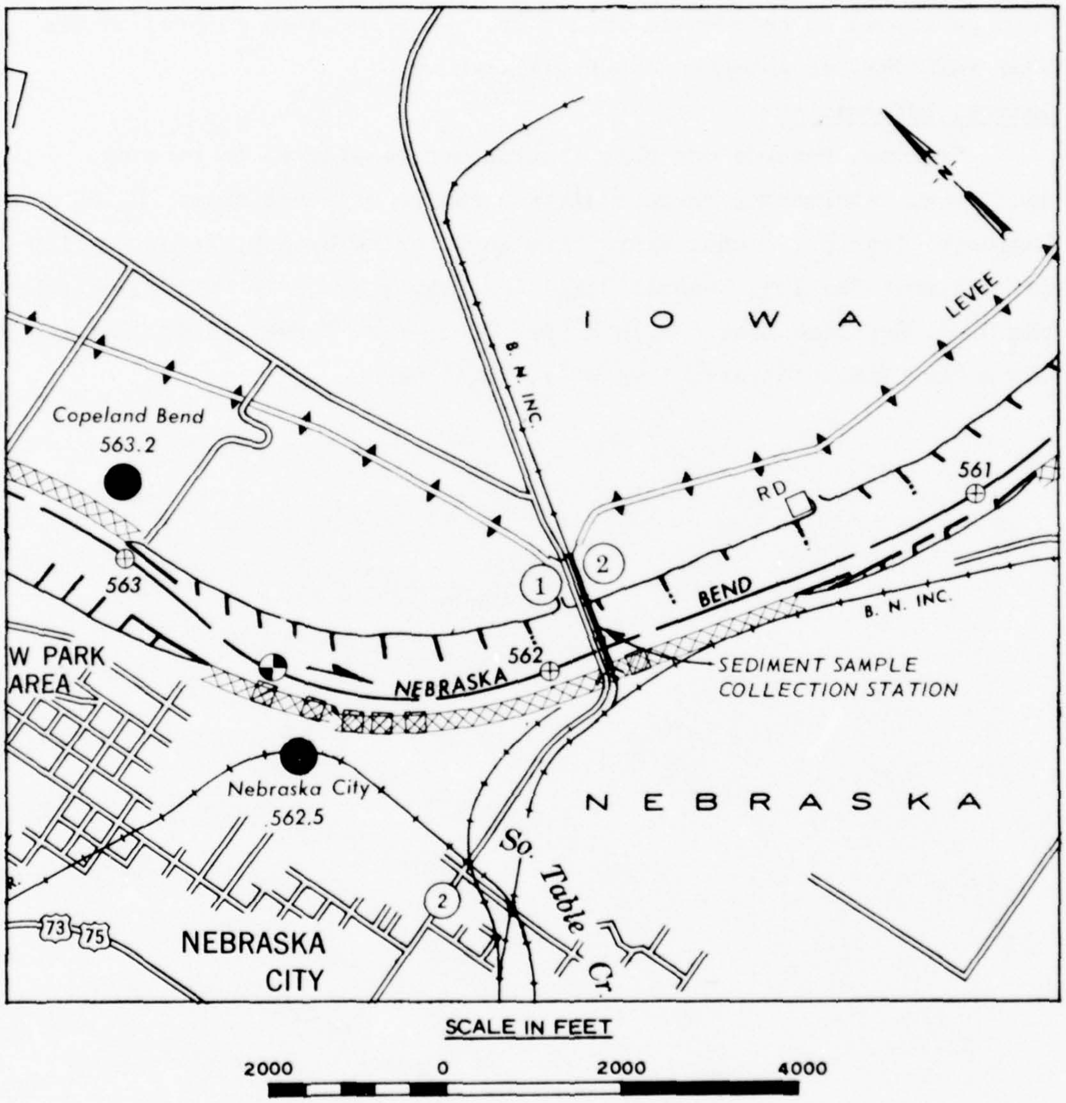


Figure A89. Site location for Nebraska City, Nebraska, sediment sample collection station (Source: Chart 34, Missouri River Navigation Charts, U. S. Army Engineer Division, Missouri River, Omaha, Nebraska, 1973)

MISSOURI RIVER MAIN STEM

06807000 MISSOURI RIVER AT NEBRASKA CITY, NEBRASKA

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	51400	1040	144000	38500	369	38400	31400	422	35800
2	53800	1300	189000	41200	400	44500	31400	475	40300
3	50300	872	118000	42400	490	56100	31400	570	48300
4	48600	730	95800	42100	689	78300	31800	692	59400
5	46800	550	69500	41500	878	98400	31800	793	68100
6	45400	540	66200	40900	862	95200	29900	742	59900
7	44500	558	67000	41200	789	87800	29500	697	55500
8	43900	580	68700	40900	728	80400	28100	641	48600
9	42700	603	69500	40900	662	73100	27400	611	45200
10	48500	1090	143000	40300	600	65300	28100	620	47000
11	78200	2420	511000	40000	527	56900	28100	638	48400
12	82200	2400	533000	39700	459	49200	27900	637	48000
13	66700	1500	270000	39100	397	41900	28800	663	51600
14	53200	1050	151000	39700	613	65700	29000	656	51400
15	47500	872	112000	41200	770	85700	28600	639	49300
16	43600	772	90900	40900	543	60000	27700	590	44100
17	42700	687	79200	39700	452	48400	27000	551	40200
18	42100	589	67000	40600	570	62500	26600	480	34500
19	41500	539	60400	40000	578	62400	24800	379	25400
20	41200	542	60300	40300	448	48700	23200	308	19300
21	40000	563	60800	43900	570	67600	22000	239	14200
22	40000	631	68100	49600	1080	145000	21600	224	13100
23	39400	667	71000	47800	950	123000	21800	532	31300
24	38800	625	65500	46100	760	94600	23200	257	16100
25	38500	552	57400	44800	635	76800	25400	307	21100
26	38500	452	47000	44800	684	82700	25400	315	21600
27	38800	440	46100	40300	561	61000	25400	302	20700
28	38500	452	47000	37400	494	49900	25900	336	23500
29	37900	542	55500	34400	462	42900	26100	366	25800
30	37400	509	51400	32100	426	36900	25900	350	24500
31	37400	392	39600	--	--	--	24500	282	18700
TOTAL	1440000	--	3574900	1232300	--	2079300	839700	--	1150900

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	23200	242	15200	37100	838	83900	35100	633	60000
2	22300	218	13100	37100	854	85500	35100	630	59700
3	21800	204	12000	35600	822	79000	34400	617	57300
4	21800	230	13500	33800	775	70700	34600	610	57000
5	22300	278	16700	33800	738	67300	34100	607	55900
6	21800	289	17000	32400	687	60100	34100	593	54600
7	21600	261	15200	31100	638	53600	33800	577	52700
8	21600	239	13900	31600	582	49700	33600	565	51300
9	21000	210	11900	31400	548	46500	33400	547	49300
10	20600	190	10600	30600	560	46300	33600	543	49300
11	19800	179	9570	29900	548	44200	33400	540	48700
12	18800	210	10700	30200	555	45300	33600	530	48100
13	18500	278	13900	32100	640	55500	34100	515	47400
14	18500	287	14300	34800	740	69500	34100	500	46000
15	18500	250	12500	36100	835	81400	34100	479	44100
16	20000	190	10300	36100	885	86300	33600	463	42000
17	28500	145	11200	35800	885	85500	33600	450	40800
18	31000	159	13300	40000	1040	112000	33400	439	39600
19	33000	275	24500	44200	1220	146000	33400	435	39200
20	32100	450	39000	44500	1020	123000	33800	477	43500
21	31100	551	46300	43600	1010	119000	34800	542	50900
22	30800	553	46000	41500	950	106000	37100	627	62800
23	31400	556	47100	37100	910	91200	39400	723	76900
24	31600	557	47500	36100	870	84800	43900	876	104000
25	31400	560	47500	34400	828	76900	43000	808	93800
26	32100	559	48400	32800	758	67100	43900	800	94800
27	32600	548	48200	32600	668	58800	44500	780	93700
28	32800	558	49400	34400	637	59200	43000	635	73700
29	32800	620	54900	--	--	--	43000	522	60600
30	33600	702	63700	--	--	--	42700	508	58600
31	35600	778	74800	--	--	--	41500	582	65200
TOTAL	812500	--	872170	990700	--	2154300	1135700	--	1821500

Figure A90. Example of sediment data for Nebraska City, Nebraska (Source: Water Resources Data for Iowa, 1974, USGS, Iowa City, Iowa) (sheet 1 of 2)

MISSOURI RIVER MAIN STEM

06807000 MISSOURI RIVER AT NEBRASKA CITY, NEBR.--CONTINUED

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	40000	670	72400	41200	540	60100	42700	3170	365000
2	41800	795	89700	42100	450	51200	41200	2360	263000
3	41800	840	94800	41800	438	49400	40300	1410	153000
4	43000	975	113000	40900	437	48300	39400	950	101000
5	44200	1040	124000	40600	428	46900	37400	730	73700
6	45100	955	116000	39400	419	44600	37400	570	57600
7	44500	708	85100	38500	438	45500	39100	800	84500
8	44500	725	87100	39400	457	48600	41200	1320	147000
9	44800	740	89500	40000	370	40000	44500	1840	221000
10	44500	580	69700	39100	348	36700	42100	1370	156000
11	45100	570	69400	40600	503	55100	42100	1160	132000
12	45800	530	65500	43300	800	93500	44800	1430	173000
13	46100	445	55400	44200	890	106000	44500	1620	195000
14	47800	660	85200	41200	800	89000	43000	980	114000
15	48200	750	97600	41500	930	104000	43000	882	102000
16	46400	620	77700	40600	820	89900	41200	758	84300
17	46400	578	72400	42700	2400	277000	41800	695	78400
18	45400	545	66800	46400	2480	311000	41500	690	77300
19	45800	472	58400	71800	8220	1590000	40000	612	66100
20	44800	500	60500	75000	6920	1400000	38200	565	58300
21	45100	575	70000	50300	4130	561000	38500	612	63600
22	44800	630	76200	49200	4000	531000	38200	580	59800
23	45100	660	80400	48200	4550	592000	38200	590	60900
24	44800	618	74800	40900	3000	331000	40900	900	99400
25	43000	538	62500	40000	2120	229000	43300	1380	161000
26	42700	460	53000	41200	1200	133000	40000	1220	132000
27	42400	425	48700	44500	1800	216000	36600	880	87000
28	42100	470	53400	44500	1720	207000	37100	692	69300
29	45800	865	107000	42400	1080	124000	36800	563	55900
30	43000	567	65800	50000	4260	575000	35600	403	38700
31	--	--	--	48600	4520	593000	--	--	--
TOTAL	1334800	--	2342000	1390100	--	8678800	1210600	--	3529800

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	36100	390	38000	36800	386	38400	36600	417	41200
2	36600	410	40500	37100	413	41400	37100	491	49200
3	36100	395	38500	38500	432	44900	37100	460	46100
4	36400	484	47600	37900	407	41600	36600	500	49400
5	36100	530	51700	37900	395	40400	36400	573	56300
6	35800	512	49500	38200	382	39400	35600	602	57900
7	35800	607	58700	37900	370	37900	35400	608	58100
8	35800	597	57700	37900	380	38900	35600	605	58200
9	35800	588	56800	38500	418	43500	35400	588	56200
10	35800	507	49000	40600	609	66800	35400	568	54300
11	35800	410	39600	40900	850	93900	36100	571	55700
12	36400	393	38600	38800	797	83500	38200	761	78500
13	36400	518	50900	37600	750	76100	38500	817	84900
14	36100	502	48900	40600	900	98700	38200	692	71400
15	35800	482	46600	40300	882	96000	37400	568	57400
16	35100	460	43600	42100	916	104000	36600	457	45200
17	35400	370	35400	40900	850	93900	36400	365	35900
18	36100	311	30300	38800	745	78000	36600	402	39700
19	37600	360	36500	37100	643	64400	36800	402	39900
20	37400	370	37400	36100	537	52300	36800	401	39800
21	37100	390	39100	35800	477	46100	37100	410	41100
22	36800	481	47800	36100	445	43400	36400	395	38800
23	36600	530	52400	36400	429	42200	36600	398	39300
24	36400	510	50100	36100	477	46500	37600	410	41600
25	36400	488	48000	35800	514	49700	37900	490	50100
26	36800	467	46400	35800	576	55700	37400	535	54000
27	37100	448	44900	35800	540	52200	37100	516	51700
28	37100	432	43300	36100	458	44600	37100	511	51200
29	37100	416	41700	36100	390	38000	37100	508	50900
30	37100	392	39300	36100	333	32500	37100	520	52100
31	37100	372	37300	36100	322	31400	--	--	--
TOTAL	1128000	--	1386100	1170700	--	1756300	1104200	--	1546100

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 13789300
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 30892170

Figure A90 (sheet 2 of 2)

Missouri River at Omaha, Nebraska

Station identification

OWDC No.: CE, 54735; USGS, 67331

Agency station No.: CE, 801; USGS, 06610000

Latitude/longitude: 411530/955520

Agency reporting to OWDC: CE; USGS

River mile: 613.9 (Mile 0 is at the confluence of the Missouri and the Mississippi rivers; miles 0-498.4 established by the CE in 1960, and upstream from mile 498.4 established by the CE in 1972.)

Site descriptions

Prior to 1973, the station was at the Aksarben Bridge* (mile 615.9) on a straight reach of the Missouri River at Omaha (Figure A91). The streambed material consists of sand and gravel, and the gradient of the bed is approximately 0.8 ft/mile. The channel is regulated for navigation and flood control and is not subject to overflow. There are dikes on the left bank and revetment on the right bank above the bridge (placed prior to establishment of the station). On 18 October 1973, the station was moved to its present location (mile 613.9) on the Interstate Highway 80 Bridge (Figure A91). The present site is on a bend in the river with revetment on the left bank and submerged dikes on the right bank. There are several large docks upstream from the station on the left bank. No tributaries or distributaries influence flow near either site. Flow has been partially controlled by Gavins Point Dam since July 1955. The discharges of record (from 1928 to July 1955) are: maximum - 369,000 cfs; mean - 28,000 cfs; and minimum - 2,200 cfs. From July 1955 to the present, the discharges of record are: maximum - 100,000 cfs; mean - 29,000 cfs; and minimum - 4,800 cfs. The sediment loads of record (from 1939 to July 1959) are: maximum - 8,500,000 tons/day; mean - 447,900 tons/day; and minimum - 2,600 tons/day. The sediment

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* Replaced by the present I-480 Bridge in 1973.

loads of record (July 1955 to the present) are: maximum - 3,170,000 tons/day; mean - 79,400 tons/day; and minimum - 1,780 tons/day.

Station chronological record

The station was established in 1939 by the CE Omaha District (OD) to study the degradation of the Missouri River. Operations were conducted by the OD until 1 July 1972, when the USGS Iowa District took over under contract to the OD. Operations are detailed in the following tabulation:

Activity	Responsible Agency	Date
Sample collection	OD USGS Iowa District	1 April 1939 - 30 June 1972 1 July 1972 - present
Sample laboratory analysis	Missouri River Division Soils Laboratory USGS Soils Laboratory	1 April 1939 - 30 June 1972 1 July 1972 - present
Data reduction	OD USGS Iowa District	1 April 1939 - 30 June 1972 1 July 1972 - present
Data publication	OD Kansas City District USGS Iowa District*	1939 - 1969 1970 - present 1 July 1972 - present

* Data are also available from WATSTORE, an automated information retrieval program operated by the USGS.

Sample and data collection procedures

Samples were collected by the OD once every four days from 1 April 1939 to 30 June 1972, with additional samples taken during high flows. The USGS Iowa District began collecting samples on 1 July 1972 each time the discharge was measured (normally twice a week during the navigation season). Details are tabulated below:

Date	Type of Sample	Equipment Used	Description or Purpose of Procedure
			OD
1939-48	Surface	Milk bottles	To attempt to correlate surface sediment concentration with the concentrations obtained from point samples. Samples also were taken with milk bottles during heavy debris and ice flows to avoid risk of losing a point sampler.

(Continued)

Date	Type of Sample	Equipment Used	Description or Purpose of Procedure
		OD (Continued)	
1939-48	Point	Omaha sampler	Samples were taken on five verticals* distributed across the stream, with three samples taken on each vertical for depths less than 10 ft and more (number varies) for depths over 10 ft.
1948-55	Point	US P-46 sampler	Samples were taken on five verticals, as above.
1955-59	Point- and depth-integrated	US P-46 sampler	Samples were taken on ten verticals. During the first three weeks of each month, point samples were taken on odd verticals. During the fourth week, depth-integrated samples were also taken, two on odd verticals and one on even verticals. (Samples were taken once every four days, regardless of timing by weeks.)
1960-64	Depth-integrated	US P-46 sampler	Depth-averaged samples were taken every four days on odd verticals.
1965-72	Depth-integrated	US P-61 or P-62 sampler	Depth-integrated samples were taken every four days on odd verticals.
1960-72	Point-integrated	US P-61 or P-62 sampler	Point-integrated samples were taken during the fourth week of each month on even verticals.
1937-54	Bed	Drag bucket	Random samples of bed material were taken.
1954-72	Bed	US BM-54 sampler	Random samples of bed material were taken.
		USGS Iowa District	
1972-present	Depth-integrated	US P-61 sampler	Depth-integrated samples are taken on three verticals along the cross section to comprise a set. Temperature and conductivity are noted for all samples.

(Continued)

* The points on the verticals were determined by Luby tables; the horizontal spacings between verticals were determined by the equal-discharge-rate method. All procedures are described in Reference 1a.

Date	Type of Sample	Equipment Used	Description or Purpose of Procedure
			USGS Iowa District (Continued)
	Bed	US BM-54 sampler	Samples of bed material are taken once each month. Temperature and conductivity are noted for all samples.

During the time when samples were collected at the Aksarben Bridge (prior to 1973), a Type E mobile crane was used to lower the sampling apparatus. A monorail with a winch attached has been installed at the I-80 Bridge and is currently used for the sampling operation.

Gaging in the vicinity of Omaha began on 10 April 1872. The following tabulation lists the gaging and recording devices used during the period of record and the agencies responsible for collecting these data:

Period	Locality	Device Used
	Union Pacific Railroad Company	
10 April 1872 - 31 August 1878	Union Pacific Railroad bridge (mile 615.3)	Cable gage
	CE (later OD)	
1 September 1878 - 26 April 1879	Union Pacific Railroad bridge (mile 615.3)	Cable gage
27 April 1879 - 20 May 1886	Foot of Farnam Street (mile 615.4)	Staff gage
21 May 1886 - 18 November 1886	Union Pacific Railroad bridge (mile 615.3)	Cable gage
19 November 1886 - 9 March 1887	Temporary bridge (mile not known)	Cable gage
10 March 1887 - 28 February 1907	Union Pacific Railroad bridge (mile 615.3)	Cable gage
? - present	Downstream from I-480 bridge (mile 615.9)	Stevens remote registering system
	U. S. Weather Bureau (now National Weather Service)	
1 March 1907 -	Aksarben Bridge	Chain-and-weight gage

(Continued)

Period	Locality	Device Used
U. S. Weather Bureau (now National Weather Service) (Continued)		
21 September 1934	(mile 615.9)	
22 September 1934 - 2 March 1968	Aksarben Bridge (mile 615.9)	Type A wire-weight gage
7 February 1952 - present	Right bank downstream from I-480 Bridge (mile 615.9)	Stevens Type T-4 Telemark gage
USGS		
1 September 1928 - 30 November 1929	Illinois Central Railroad bridge (mile 617.9)	Chain gage
1 December 1929 - 26 May 1930	Aksarben Bridge (mile 615.9)	Chain-and-weight gage (Weather Bureau property)
27 May 1930 2 May 1968	Aksarben Bridge (mile 615.9)	Canfield wire-weight gage
19 October 1931 - 30 September 1936	Nebraska Power and Light Company intake well (mile 615.5)	Stevens recording gage
1 October 1936 - 4 February 1952	Aksarben Bridge (mile 615.9	Friez and Stevens recording gages
7 February 1952 - present	Right bank downstream from I-480 Bridge (mile 615.9)	Stevens A-35 water-stage recorder*
1 October 1965 - present	Right bank downstream from I-480 Bridge (mile 615.9)	Fisher-Porter automatic digital recorder

* Since 1 October 1965 operated as an auxiliary recorder.

Laboratory sample analysis

Information is identical to that presented for the Boyer River (East Fork) sediment sample collection station at Denison, Iowa.

Data reduction procedures

Information is identical to that presented for the Boyer River (East Fork) sediment sample collection station at Denison, Iowa.

Data reporting procedures

Information is identical to that presented for the Little Sioux River sediment sample collection near Turin, Iowa. Figure A92 is an example of sediment data for this station.

General information

Sediment records for this station are considered to be good, with the possible exception of the samples taken with the Omaha sampler. The nozzle on this sampler is in the shape of a right angle, and the intake is positioned perpendicular to the stream flow during the sampling procedure. There is some question as to whether the larger sediment could follow the streamlines at the nozzle intake.

Additional information on this station can be obtained from: U. S. Army Engineer District, Omaha, Hydrologic Engineering Branch, Water Quality and Sediment Section, Federal Building, Omaha, Nebraska 68102; or from the U. S. Department of the Interior, Geological Survey, Iowa District, 400 South Clinton Street, Iowa City, Iowa 52240.

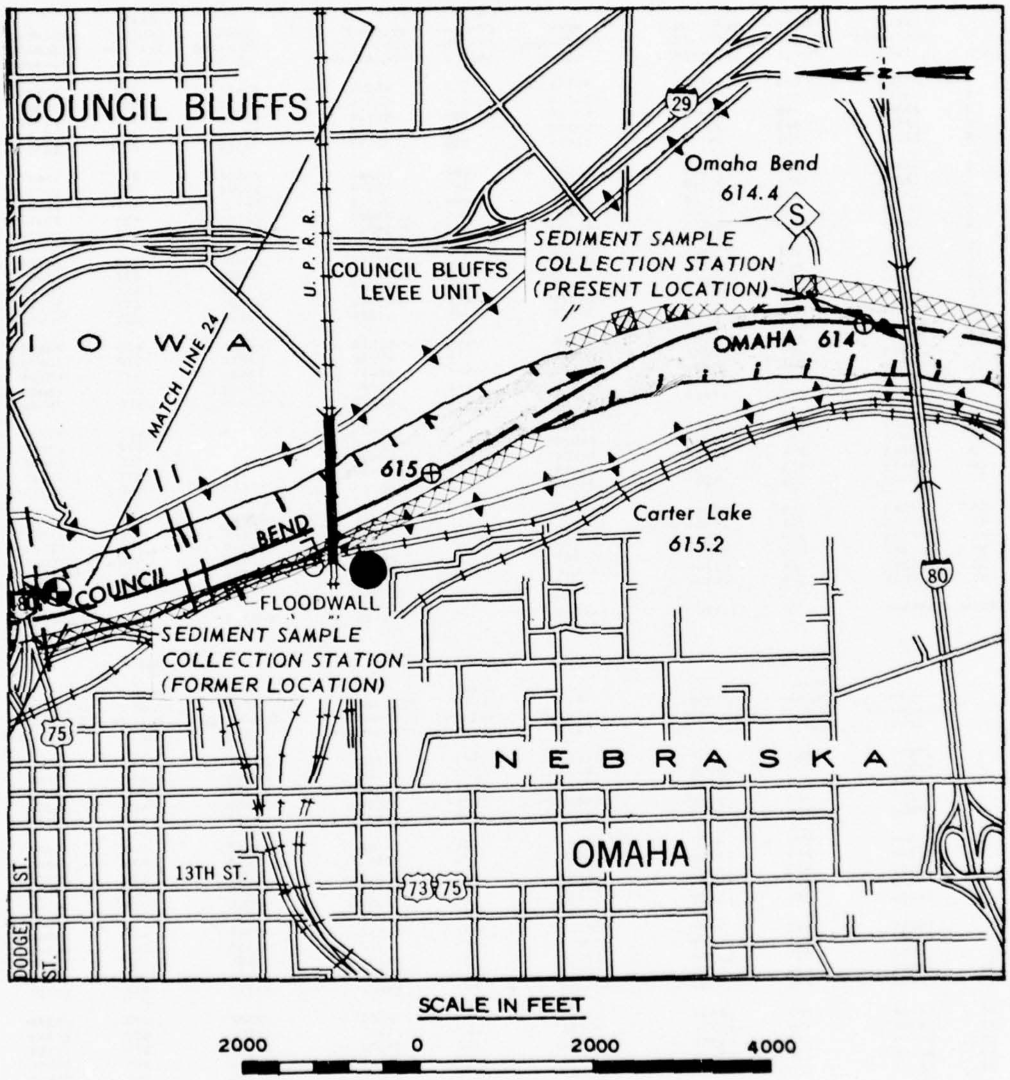

Figure A91. Site locations for Omaha, Nebraska, sediment sample collection station (Source: Chart No. 25, Missouri River Navigation Charts, U. S. Army Engineer Division, Missouri River, Omaha, Nebraska, 1973)

MISSOURI RIVER MAIN STEM

MISSOURI RIVER AT OMAHA, NEBRASKA

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	34400	583	54100	31000	538	45000	23400	330	20800
2	33400	402	36300	31800	630	54100	23100	309	19300
3	33200	395	35400	33000	585	52100	22900	383	23700
4	33800	385	35100	33400	490	44200	22700	284	17400
5	33700	375	34100	33200	358	32100	22100	273	16300
6	33300	366	32900	32500	302	26500	20600	245	13600
7	33200	360	32300	32300	345	30100	19200	210	10900
8	33100	352	31500	32100	449	38900	19200	272	14100
9	32500	355	31200	32000	440	38000	20700	498	27800
10	33500	355	32100	31400	392	33200	21000	463	26300
11	39400	955	102000	31200	338	28500	20600	372	20700
12	38100	940	96700	31800	361	31000	20300	331	18100
13	33100	630	56300	31600	477	40700	21400	521	30100
14	31300	535	45200	31800	605	51900	22500	637	38700
15	31000	522	43700	32000	669	57800	21100	551	31400
16	29200	483	38100	32100	640	55500	20000	433	23400
17	29400	420	33300	31800	578	49600	20200	378	20600
18	29000	355	27800	32000	525	45400	19900	349	18800
19	27200	315	23100	31600	480	41000	19800	347	18600
20	27400	305	22600	32700	551	48600	20800	505	28400
21	27200	307	22500	33900	752	68800	20600	462	25700
22	27200	329	24200	34500	777	72400	19500	372	19600
23	27200	364	26700	34100	701	64500	19500	380	20000
24	27400	370	27400	33900	609	55700	21400	581	33600
25	27600	335	25000	33600	510	46300	21700	645	37800
26	27700	295	22100	32000	410	35400	20500	511	28300
27	27900	278	20900	29200	368	29000	20100	402	21800
28	28100	302	22900	26400	380	27100	19800	331	17700
29	27800	355	26600	24000	390	25300	19400	287	15000
30	28200	356	27100	23400	360	22700	18600	269	13500
31	29000	379	29700	--	--	--	17500	257	12100
TOTAL	954500	--	1118900	946300	--	1291400	640100	--	684100

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	17000	242	11100	24000	907	58800	23200	456	28600
2	17500	230	10900	22600	823	50200	22600	400	24400
3	17400	217	10200	20000	611	33000	22600	390	23800
4	17200	208	9660	19800	626	33500	23200	428	26800
5	17000	195	8950	19700	575	30600	23300	467	29400
6	16900	190	8670	17600	401	19100	23100	469	29300
7	17100	243	11200	18100	373	18200	22800	435	26800
8	17500	403	19000	20000	477	25800	22600	421	25700
9	16900	375	17100	19900	500	26900	22800	449	27600
10	16300	295	13000	20500	439	24300	22900	469	29000
11	13500	210	7650	20700	331	18500	22700	482	29500
12	13300	247	8870	20800	255	14300	22500	433	26300
13	14100	319	12100	22100	330	19700	22400	387	23400
14	13800	220	8200	23900	845	54500	23200	503	31500
15	14800	220	8790	23400	868	54800	22700	518	31700
16	17700	387	18500	21400	567	32800	22000	479	28500
17	22300	709	42700	20900	412	23200	22500	522	31700
18	24900	972	65300	23900	590	38100	22400	515	31100
19	24500	810	53600	26000	1350	94800	22300	495	29800
20	22500	527	32000	26100	670	47200	22900	560	34600
21	20600	369	20500	24500	835	55200	27200	840	61700
22	20000	270	14600	23400	517	32700	31500	1500	128000
23	20200	212	11600	22600	408	24900	33900	1660	152000
24	20200	200	10900	22200	350	21000	32600	915	80500
25	20300	263	14400	21600	323	18800	31900	430	37000
26	20400	390	21500	21800	323	19000	31500	392	33300
27	20900	449	25300	23100	430	26800	31900	381	32800
28	20800	459	25800	23400	495	31300	32500	380	33300
29	20500	442	24500	--	--	--	32500	550	48300
30	20500	413	22900	--	--	--	31300	510	43100
31	22300	560	33700	--	--	--	30600	565	46700
TOTAL	578900	--	603190	614000	--	948000	802100	--	1266200

Figure A92. Example of sediment data for Omaha, Nebraska (Source: Water Resources Data for Iowa, 1974, USGS, Iowa City, Iowa) (sheet 1 of 2)

MISSOURI RIVER MAIN STEM

MISSOURI RIVER AT OMAHA, NEBRASKA--CONTINUED

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	31100	741	62200	33400	412	37200	35700	3660	353000
2	32200	771	67000	32800	455	40300	35100	1300	123000
3	33200	630	56500	31900	413	35600	35300	811	77300
4	33100	400	35700	31800	411	35300	34400	650	60400
5	33700	425	36700	31800	413	35500	33200	520	46600
6	33300	411	37000	30900	359	30000	35400	585	55900
7	33200	405	36300	32300	427	37200	37000	1040	104000
8	33600	439	39800	33900	571	52300	38100	1460	150000
9	33600	440	39900	34000	518	47600	37300	1190	120000
10	33600	403	36600	32600	420	37000	36700	1010	100000
11	35200	465	46100	33800	740	67500	36400	915	89900
12	35400	563	53800	34100	860	79200	35400	860	82200
13	35500	597	57200	32400	732	64000	34700	815	76400
14	35700	602	58000	33300	644	57900	35200	740	70300
15	35000	568	53700	34800	624	58600	35300	645	61500
16	33800	500	45600	36100	824	80300	35000	596	56300
17	33200	429	38500	35100	818	77500	34800	565	53100
18	34100	455	41900	38700	4100	428000	35100	512	48500
19	33400	539	48600	47900	8160	1060000	33100	415	37100
20	33700	562	51100	37800	5220	533000	33500	690	62400
21	33700	571	52000	34700	2620	245000	34600	828	77400
22	32600	445	39200	35000	2150	203000	34500	685	63800
23	33800	429	39200	33000	800	71300	35800	660	63800
24	33300	438	39400	33700	1220	111000	40800	1960	216000
25	33000	425	37900	35600	1890	182000	42000	2580	293000
26	32500	386	34000	37300	1650	166000	36600	1680	166000
27	32400	350	30600	38400	1200	124000	35500	770	73800
28	33200	377	33800	36600	900	88900	35100	470	44500
29	34200	447	41300	37600	3020	307000	33900	385	35200
30	32900	400	35500	41500	7350	824000	33600	360	32700
31	--	--	--	38100	6580	677000	--	--	--
TOTAL	1007200	--	1327100	1090900	--	5893200	1069100	--	2894100

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	35000	540	51000	37100	458	45900	35200	582	55300
2	35400	655	62600	37700	505	51400	34900	580	54700
3	35300	615	58600	37500	510	51600	34200	562	51900
4	35700	590	56900	37200	477	47900	34100	528	48600
5	35800	608	58800	37000	433	43300	34000	488	44800
6	35300	570	54300	36700	423	41900	34300	439	40700
7	35000	480	45400	36500	443	43700	34500	444	41400
8	34500	400	37300	37000	478	47800	34600	458	42800
9	34800	380	35700	38000	548	56200	34500	453	42200
10	35100	423	40100	39400	630	67000	35000	458	43300
11	36000	555	53900	39300	668	70900	35900	475	46000
12	36300	613	60100	37800	648	66100	36900	485	48300
13	36100	560	54600	37900	656	67100	37000	494	49400
14	35700	482	46500	39400	670	71300	36800	485	48200
15	35300	430	41000	38500	618	64200	35900	459	44500
16	35300	378	36000	38600	612	63800	35500	420	40300
17	35300	356	33900	37400	602	60800	35100	365	34600
18	36500	422	41600	36100	589	57400	35200	348	33100
19	37300	492	49500	35500	578	55400	35500	390	37400
20	36700	452	44800	35100	578	54600	35700	420	40500
21	36300	421	41300	35100	580	55000	35800	425	41100
22	36600	482	47600	35000	597	56400	35900	399	38700
23	36500	497	49000	34300	592	54800	35900	355	34400
24	36100	481	46900	34300	560	51900	36300	338	33100
25	35900	480	46500	34400	529	49100	36500	328	32300
26	36400	474	46600	34400	495	46000	36200	325	31800
27	36200	458	44800	34200	380	35100	36200	317	31000
28	36300	437	42800	34500	378	35200	36500	309	30500
29	36400	418	41100	35000	470	44400	36500	299	29500
30	36800	400	39700	34900	458	43200	36600	283	28000
31	36800	407	40400	34900	479	45100	--	--	--
TOTAL	1112700	--	1449300	1130700	--	1644700	1067200	--	1218400

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 11013700
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 20338590

Figure A92 (sheet 2 of 2)

Missouri River at Sioux City, Iowa

Station identification

OWDC No.: CE, 54734; USGS, 75469

Agency station No.: CE, 701; USGS, 06486000

Latitude/longitude: 422910/962445

Agency reporting to OWDC: CE; USGS

River mile: 732.2 (Mile 0 is at the confluence of the Missouri and Mississippi rivers; miles 0-498.4 established by the CE in 1960, and upstream from mile 498.4 established by the CE in 1972.)

Site description

The station is on the Combination (U. S. Highway 77) Bridge on a straight reach of the Missouri River at Sioux City, Iowa (Figure A93). The streambed material consists of sand and gravel, and the gradient of the bed is approximately 0.8 ft/mile. The channel is regulated for navigation and flood control and is not subject to overflow; it is stabilized by revetment and dikes upstream to mile 753.0, which serve to deflect the flow to midstream. There is a marina on each bank 0.5 mile upstream from the station; also, the Big Sioux River empties into the Missouri 2 miles upstream. Flow has been partially controlled by Gavins Point Dam since July 1955. The discharges record (1879-July 1955) are: maximum - 441,000 cfs; mean - 30,000 cfs; and the minimum - 2,500 cfs. From July 1955 to the present, the discharges of record are: maximum - 80,000 cfs; mean - 32,730 cfs; and minimum - 5,000 cfs.

Station chronological record

The station was established by the CE in 1954 to monitor the sediment contribution of the Big Sioux River to the Missouri River and to continue to study the degradation of the Missouri River. This particular site was chosen because the U. S. Highway 77 Bridge was the only bridge crossing the Missouri in the reach of the river from Yankton, South Dakota, to Omaha, Nebraska (190 river miles), that was suitable as a sediment sample collection station site. Operations were conducted by

the CE Omaha District (OD) until 1 July 1972, when the USGS Iowa District took over under contract to OD. Operations are detailed in the following tabulation:

Activity	Responsible Agency	Date
Sample collection	OD	1 October 1954 - 30 June 1972
	USGS Iowa District	1 July 1972 - present
Laboratory sample analysis	Missouri River Division Soils Laboratory	1 October 1954 - 30 June 1972
	USGS Soils Laboratory	1 July 1972 - present
Data reduction	OD	1 October 1954 - 30 June 1972
	USGS Iowa District	1 July 1972 - present
Data publication	OD	1954 - 1969
	Kansas City District	1970 - present
	USGS Iowa District*	1 July 1972 - present

* Data are also available from WATSTORE, an automated information retrieval program operated by the USGS.

Sample and data collection procedures

Samples were collected by the OD once every four days from 1 October 1954 to 30 June 1972, with additional samples taken during high flows. The USGS Iowa District began collecting samples on 1 July 1972 each time the discharge was measured, normally twice a week during the navigation season. Samples are taken from the pedestrian walkway of the Combination Bridge using a Type E mobile crane to lower the sampling apparatus. Details are tabulated below:

Date	Type of Sample	Equipment Used	Description or Purpose of Procedure
			OD
1954-59	Point- and depth-integrated	US P-46 sampler	Samples were taken on ten verticals.* During the first three weeks of month, point samples were taken on

(Continued)

* The points on the verticals were determined by Luby tables; the horizontsl spacing between verticals was determined by the equal-discharge-rate method. All procedures are described in Reference 1a.

Date	Type of Sample	Equipment Used	Description or Purpose of Procedure
		OD (Continued)	
			odd verticals. During the fourth week, depth-integrated samples were also taken, two on odd verticals and one on even verticals. (Samples were taken once every four days, regardless of timing by weeks.)
1960-72	Depth-integrated	US P-46, US P-49, and US D-43 samplers	Depth-integrated samples were taken every four days on odd verticals.
1960-72	Point-integrated	US P-46 sampler	Point-integrated samples were taken during the fourth week of each month on even verticals.
1954-72	Bed	US BM-54 sampler	Random samples of bed material were taken.
		USGS Iowa District	
1972-present	Depth-integrated	US P-61 sampler	Depth-integrated samples are taken at three verticals along the cross section to comprise a set. Temperature and conductivity are measured for all samples.
1972-present	Bed	US BM-54 sampler	Samples of bed material are taken once each month. Temperature and conductivity are measured for all samples.

Gaging at Sioux City in the vicinity of mile 732.0 began on 2 September 1878. The present gage is on the Nebraska side of the Combination Bridge, the same bridge from which sediment samples are collected (mile 723.3). The tabulation summarizes the gaging and recording devices used during the period of record and the agencies responsible for collecting these data:

Period	Locality	Device Used
	Missouri River Commission	
2 September 1878 - 7 November 1882	Mouth of Perry Creek	Staff gage
1878? - 26 October 1888	Foot of Pearl Street	Staff gage (supplementary)
8 November 1882 - early May 1883	Downstream from Perry Creek	Staff gage
Early May 1883 - 26 October 1888	Mouth of Perry Creek	Staff gage
26 October 1888 - 31 December 1899	Chicago, Minneapolis, and St. Paul Railroad bridge	Cable-and-weight gage
	U. S. Signal Corps	
1 July 1887 - 4 August 1889; 8 October 1889 - 19 August 1890; 21 October 1890 - 31 August 1891; and 14 November 1891 - 31 December 1899	Mouth of Perry Creek	Staff gage
5 August 1889 - 7 October 1889, and 20 - 31 August 1890	Foot of Douglas Street	Staff gage (temporary)
1 September 1890 - 20 October 1899	Pacific Short Line Bridge (now Combination Bridge)	Staff gage (temporary)
	U. S. Weather Bureau (now National Weather Service)	
1 January 1900 - 31 December 1905	Mouth of Perry Creek	Staff gage
1 January 1906 - 30 September 1931	Combination Bridge	Chain gage
1 October 1931 - 13 February 1935	Combination Bridge	Chain and weight gage
14 February 1935 - present	Combination Bridge	Stevens A-35 water-stage recorder (driven by manometer since 1964)
2 December 1936 - present	Combination Bridge	Type A wire-weight gage

(Continued)

Period	Locality	Device Used
U. S. Weather Bureau (now National Weather Service) (Continued)		
18 September 1957 - present	Combination Bridge	Stevens Telemark gage (driven by manometer since 1964)
USGS		
1 September 1928 - 30 September 1931	Combination Bridge	Chain gage
2 September 1931 - 1 December 1936	Combination Bridge	Chain-and-weight gage
14 February 1935 - present	Combination Bridge	Stevens A-35 water-stage recorder (driven by manometer since 1964)
2 December 1936 - present	Combination Bridge	Type A wire-weight gage

Laboratory sample analysis

Information is identical to that presented for the Boyer River (East Fork) sediment sample collection station at Denison, Iowa.

Data reduction procedures

Information identical to that presented for the Boyer River (East Fork) sediment sample collection station at Denison, Iowa.

Data reporting procedures

Sediment data are published in Reference 11. Figure A94 is an example of these data. Discharge data for years prior to 1961 were published in Reference 12, and for 1961 to the present the data have been published in References 15 and 23. Data are also entered in the USGS WATSTORE, an automated information retrieval system.

General information

Sediment records for this station are considered to be good. The station will be moved 100 ft downstream in 1978 after the new Highway 77 Bridge is completed.

Additional information on this station can be obtained from: U. S. Army Engineer District, Omaha, Hydrologic Engineering Branch, Water

Quality and Sediment Section, Federal Building, Omaha, Nebraska 68102; or from the U. S. Department of the Interior, Geological Survey, Iowa District, 400 South Clinton Street, Iowa City, Iowa 52240.

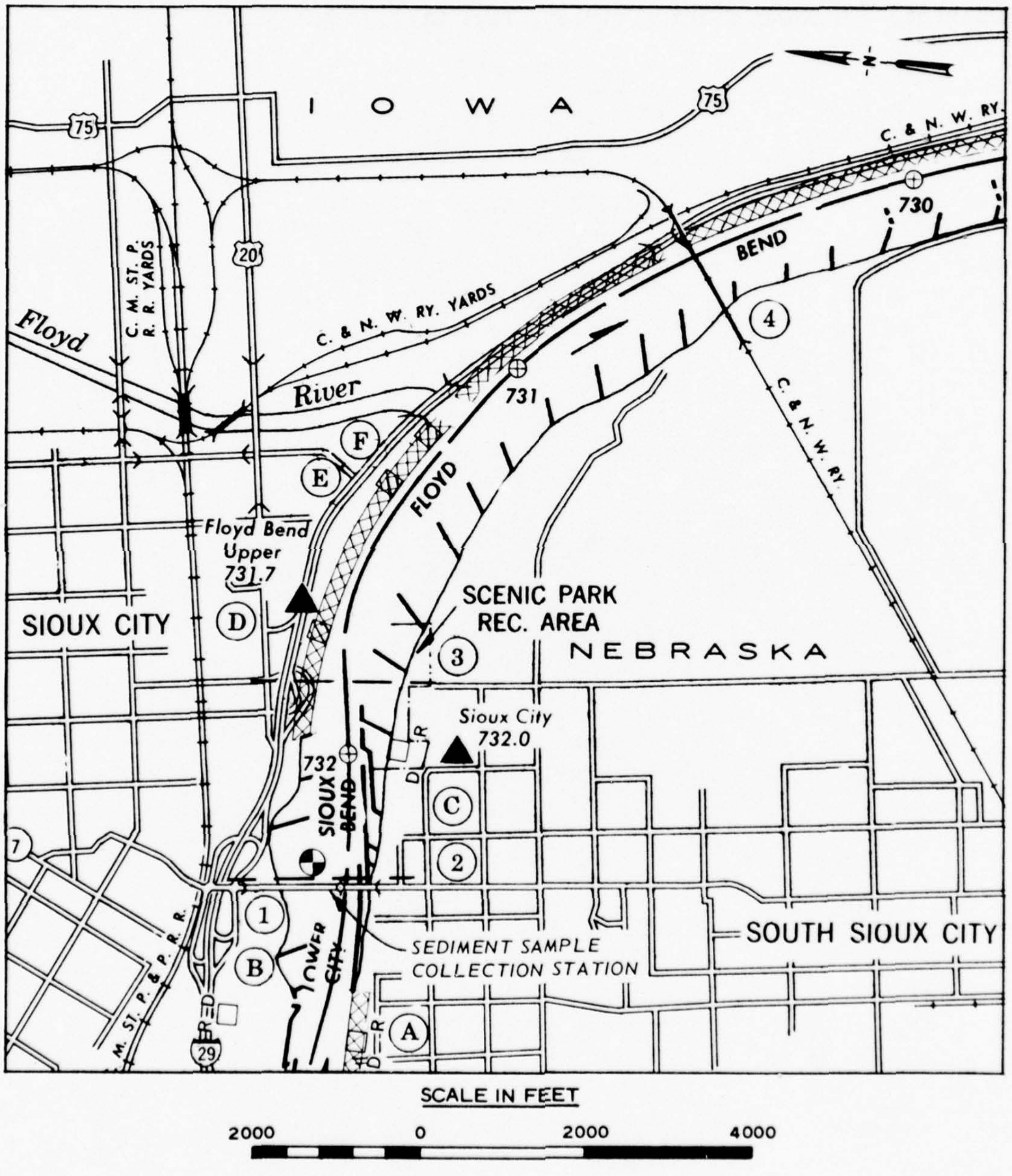

Figure A93. Site location for Sioux City, Iowa, sediment sample collection station (Source: Chart No. 5, Missouri River Navigation Charts, U. S. Army Engineer Division, Missouri River, Omaha, Nebraska, 1973)

MISSOURI RIVER MAIN STEM

06486000 MISSOURI RIVER AT SIOUX CITY, IOWA

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCEN-TRATION (MG/L)	OCTOBER SEDIMENT DISCHARGE (TONS/DAY)	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCEN-TRATION (MG/L)	NOVEMBER SEDIMENT DISCHARGE (TONS/DAY)	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCEN-TRATION (MG/L)	DECEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	32500	461	40500	32500	407	35700	18900	118	6020
2	32500	350	30700	31600	320	27300	18900	115	5870
3	32200	352	30600	31000	260	21800	18900	110	5610
4	31600	383	32700	31300	199	16800	18700	105	5300
5	31300	382	32300	31000	120	10000	18500	100	5000
6	31300	364	30800	31000	90	7530	17600	211	10000
7	31300	340	28700	31000	87	7280	17800	230	11100
8	31000	308	25800	31000	88	7370	19200	280	14500
9	31600	335	28600	31000	89	7450	18900	260	13300
10	34600	632	59000	31000	88	7370	17900	225	10900
11	32200	524	45600	31300	96	8110	18100	220	10800
12	26600	384	27600	31300	104	8790	19800	278	14900
13	27000	430	31300	31300	130	11000	19200	269	13900
14	24800	310	20800	31600	177	15100	18100	240	11700
15	24400	232	15300	31600	248	21200	17600	212	10100
16	24600	228	15100	31300	245	20700	18100	249	12200
17	24600	197	13100	30700	226	18700	17800	233	11200
18	24800	205	13700	30400	250	20500	18900	302	15400
19	24800	170	11400	30400	322	26400	19700	387	20600
20	24800	151	10100	31600	353	30100	18100	323	15800
21	24800	150	10000	31600	360	30700	18100	330	16100
22	24600	147	9760	30700	355	29400	18900	341	17400
23	24600	142	9430	30700	337	27900	20200	427	23300
24	25100	140	9490	31000	300	25100	18700	370	18700
25	25800	183	12700	29000	264	20700	18700	350	17700
26	26300	160	11400	26000	210	14700	18700	340	17200
27	25800	125	8710	22800	171	10500	18500	331	16500
28	25800	111	7730	19800	148	7910	18200	317	15600
29	25600	110	7600	19300	130	6770	17800	303	14600
30	27600	201	15000	19000	120	6160	17300	308	14400
31	31600	373	31800	--	--	--	17000	277	12700
TOTAL	866100	--	677320	883800	--	509040	572800	--	408400

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCEN-TRATION (MG/L)	JANUARY SEDIMENT DISCHARGE (TONS/DAY)	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCEN-TRATION (MG/L)	FEBRUARY SEDIMENT DISCHARGE (TONS/DAY)	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCEN-TRATION (MG/L)	MARCH SEDIMENT DISCHARGE (TONS/DAY)
1	17300	255	11900	18400	401	19900	19700	165	8780
2	16500	317	14100	18900	467	23800	20200	160	8730
3	16200	309	13500	19800	502	26800	21000	245	13900
4	16000	328	14200	17600	268	12700	21400	590	34100
5	16000	330	14300	17600	142	6750	20800	503	28200
6	16000	342	14800	20400	130	7160	20600	452	25100
7	16000	352	15200	19300	110	5730	20800	421	23600
8	16000	332	14300	19800	298	15900	21000	399	22600
9	14500	331	13000	20000	475	25700	20800	371	20800
10	13000	237	8320	20000	550	29700	20000	309	16700
11	13000	221	7760	20600	778	43300	19700	264	14000
12	13500	195	7110	21000	920	52200	19800	220	11800
13	13500	219	7980	21400	1020	58900	20400	170	9360
14	14000	289	10900	20000	640	34600	18100	88	4300
15	17000	473	21700	19200	425	22000	18900	118	6020
16	21800	597	35100	19500	315	16600	18700	110	5550
17	22000	640	38000	20000	270	14600	18500	93	4650
18	21800	620	36500	21400	380	22000	18900	107	5460
19	20400	561	30900	19300	375	19500	20800	125	7020
20	19000	500	25700	18900	335	17100	25100	390	26400
21	19500	520	27400	19000	295	15100	27600	530	39500
22	19300	462	24100	19000	250	12800	31300	738	62400
23	19300	428	22300	19000	245	12600	32800	920	81500
24	19500	418	22000	18700	172	8680	30700	888	73600
25	20000	409	22100	19300	260	13500	31300	937	79200
26	20600	428	23800	19300	430	22400	31000	840	70300
27	20800	438	24600	19000	250	12800	31000	712	59600
28	20200	380	20700	19800	225	12000	31300	579	48900
29	20400	380	20900	--	--	--	30700	463	38400
30	21200	427	24400	--	--	--	30400	448	36800
31	22000	495	29400	--	--	--	30100	457	37100
TOTAL	556300	--	616970	548200	--	584820	743400	--	924370

Figure A94. Example of sediment data for Sioux City, Iowa (Source: Water Resources Data for Iowa, 1974, USGS, Iowa City, Iowa) (sheet 1 of 2)

MISSOURI RIVER MAIN STEM

06486000 MISSOURI RIVER AT SIOUX CITY, IOWA--CONTINUED

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	30700	447	37100	30100	370	30100	31600	192	16400
2	30100	340	27600	30100	382	31000	34000	374	34300
3	31000	290	24300	30700	369	30600	31600	302	25800
4	32200	239	20800	29800	330	26600	29000	247	19300
5	30400	210	17200	28400	120	9200	31000	228	19100
6	30700	220	18200	29500	102	8120	31300	206	17400
7	31600	320	27300	31600	119	10200	30700	179	14800
8	31900	374	32200	29500	101	8040	30700	170	14100
9	31900	385	33200	29500	99	7890	32200	237	20600
10	32500	430	37700	30700	124	10300	32800	332	29400
11	31600	472	40300	30700	91	7540	30700	274	22700
12	31600	511	43600	27800	130	9760	29800	230	18500
13	30700	434	36000	29500	234	18600	30400	225	18500
14	30700	383	31700	30700	318	26400	30400	216	17700
15	30100	330	26800	30100	353	28700	30700	220	18200
16	30400	265	21800	31000	377	31600	32200	238	20700
17	31000	326	27300	31000	378	31600	34000	270	24800
18	31300	390	33000	32500	380	33300	31600	235	20100
19	31300	402	34000	32200	372	32300	33100	242	21600
20	31000	408	34100	28700	173	13400	32500	232	20400
21	30700	409	33900	24600	150	9960	31900	222	19100
22	31600	396	33800	27000	149	10900	34300	297	27500
23	29500	280	22300	30100	359	29200	40000	512	55300
24	30100	220	17900	32800	434	38400	36100	377	36700
25	30400	260	21300	32800	455	40300	30700	237	19600
26	30700	281	23300	34300	467	43200	32500	269	23600
27	31300	303	25600	32500	360	31600	32800	273	24200
28	31600	355	30300	32500	265	23300	31300	227	19200
29	28400	281	21500	32200	204	17700	33100	262	23400
30	31000	285	23900	30100	145	11800	35200	393	37400
31	--	--	--	31600	148	12600	--	--	--
TOTAL	928000	--	858000	944600	--	674210	968200	--	700400

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	33100	400	35700	38800	311	32600	33700	340	30900
2	33400	407	36700	37300	137	13800	34300	292	27000
3	33100	409	36600	37000	130	13000	33700	265	24100
4	33100	405	36200	37000	248	24800	33700	260	23700
5	34300	420	38900	37000	348	34800	34000	300	27500
6	34000	390	35800	37000	402	40200	34000	302	27700
7	34300	363	33600	37300	310	31200	34000	289	26500
8	34600	321	30000	37600	190	19300	34300	330	30600
9	34600	287	26800	38800	247	25900	34600	360	33600
10	34900	311	29300	38500	350	36400	34600	329	30700
11	35500	302	28900	38200	300	30900	35200	340	32300
12	34900	201	18900	38500	285	29600	36700	465	46100
13	34600	180	16800	38200	288	29700	36100	409	39900
14	34300	203	18800	37600	322	32700	34000	348	31900
15	34300	172	15900	37000	350	35000	34300	334	30900
16	35200	200	19000	35500	340	32600	34300	352	32600
17	37600	379	38500	34000	278	25500	34900	359	33800
18	37300	328	33000	33400	192	17300	34600	350	32700
19	37000	270	27000	33400	152	13700	34900	365	34400
20	37000	241	24100	34000	280	25700	34600	359	33500
21	37000	250	25000	33700	376	34200	34300	340	31500
22	36400	198	19500	33700	558	50800	35200	375	35600
23	36400	147	14400	33100	540	48300	36400	351	34500
24	37000	169	16900	33400	488	44000	36100	448	43700
25	37300	153	15400	33100	441	39400	35800	523	50600
26	37000	113	11300	32800	395	35000	35800	660	63800
27	36700	106	10500	32800	340	30100	35800	772	74600
28	37000	177	17700	32800	268	23700	36100	755	73600
29	37000	282	28200	32500	189	16600	35500	693	66400
30	36700	309	30600	33400	199	17900	35200	621	59000
31	37000	318	31800	33700	426	38800	--	--	--
TOTAL	1102600	--	801800	1101100	--	923500	1046700	--	1163700

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 10259800
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 8842530

Figure A94 (sheet 2 of 2)

Missouri River at Yankton, South Dakota

Station identification

OWDC No.: 54733

Agency station No.: 621

Latitude/longitude: 425158/972337

Agency reporting to OWDC: CE

River mile: 805.8 (Mile 0 is at the confluence of the Missouri and Mississippi rivers; miles 0-498.4 established by the CE in 1960, and upstream from mile 498.4 established by the CE in 1972.)

Site description

The station is on the U. S. Highway 81 Bridge at Yankton, South Dakota, on a straight nonnavigable (for commercial traffic) reach of the Missouri River (Figure A95). The streambed material consists of sands and gravels, and the channel gradient is approximately 0.9 ft/mile. There are no revetments or dikes in the vicinity of the station. Flow was partially controlled by Fort Randall Dam from July 1952 to July 1955. Since July 1955, Gavins Point Dam 5.2 miles upstream has controlled the discharge. The discharges of record prior to total flow control by Gavins Point Dam (1930-July 1955) are: maximum - 480,000 cfs; mean - 26,000 cfs; and minimum - 2,700 cfs. From July 1955 to the present, the discharges of record are: maximum - 45,800 cfs; mean - 26,000 cfs; and minimum - 15,000 cfs. The sediment loads of record (1939-July 1955) are: maximum - 10,800,000 tons/day; mean - 383,000 tons/day; and minimum - 2,720 tons/day. The sediment loads of record (July 1955-30 June 1969) are: maximum - 125,000 tons/day; mean - 5,250 tons/day; and minimum - 167 tons/day.

Station chronological record

The station was established in 1939 to study the degradation of the Missouri River. After July 1955, it was used to monitor the sediment load passing Gavins Point Dam. Sediment collection activities were terminated at this station on 30 June 1969, when the data indicated

that Gavins Point Dam was an effective sediment trap. During the period that the station was in operation, the CE Omaha District (OD) collected the samples and reduced and published the data. The CE Missouri River Division (MRD) Soils Laboratory analyzed the samples.

Sample and data
collection procedures

Samples were collected by the OD once every four days from 1 April 1939 to 30 June 1969 with additional samples taken during high flows. Details are tabulated below:

Dates	Type of Sample	Equipment Used	Description or Purpose of Procedure
1939-54	Surface	Milk bottles	To attempt to correlate surface-sediment concentration with the concentrations obtained from point samples. Samples also were taken with milk bottles during heavy debris and ice flows to avoid the risk of losing a point sampler.
1939-54	Point	Omaha sampler	Samples were taken on five verticals* distributed across the stream, with three samples taken on each vertical for depths less than 10 ft, and more (number varied) for depths over 10 ft.
1955-59	Point- and depth-integrated	US P-46 and US D-49 samplers	Samples were taken on ten verticals. During the first three weeks of each month, point samples were taken on odd verticals. During the fourth week, depth-integrated samples were also taken, two on odd verticals and one on even verticals. (Samples were taken once every four days, regardless of timing by weeks.)
1960-69	Depth-integrated	US P-46 and US P-43 samplers**	Depth-integrated samples were taken every four days on odd verticals.
1960-69	Point-integrated	US P-46 sampler**	Point-integrated samples were taken during the fourth week of each month on even verticles.

(Continued)

* The points on the verticals were determined by Luby tables; the horizontal spacing between verticals was determined by the equal-discharge-rate method. All procedures are described in Reference 1a.

** The sampling apparatus was lowered with a Type E mobile crane.

Dates	Type of Sample	Equipment Used	Description or Purpose of Procedure
1937-54	Bed	Drag bucket	Random samples of bed material were taken.
1954-69	Bed	US BM-54 sampler	Random samples of bed material were taken.

Daily gage heights at the U. S. Highway 81 Bridge at Yankton (mile 805.8) have been collected since 25 March 1873. The following tabulation presents the gaging and recording devices used at this station during the period of record as well as the agencies responsible for collecting these data:

Period	Device Used
U. S. Weather Bureau (now National Weather Service)	
25 March 1973 - 7 November 1886;* 16 March 1905 - 9 May 1908; and 7 August 1921 - 31 May 1931	Staff gages
1 June 1931 - 20 September 1934	Chain gage (USGS property)
21 September 1934 - 28 February 1963	Type A wire-weight gage
USGS	
15 November 1930 - 19 September 1932	Chain gage
20 September 1932 - 24 October 1934	Stevens A-30 water-stage recorder (driven by float)**
13 October 1934 - 1961?	Staff gage
21 September 1934 - present	Type A wire-weight gage (National Weather Service property)
25 October 1934 - present	Stevens A-30 water-stage recorder driven by float, later replaced by Stevens A-35 recorder driven by manometer†
28 February 1969 - present	Digital water-stage recorder driven by manometer†

* The gage height readings for the period of 25 March 1873 - 7 November 1886 were published by the U. S. Signal Corps.

** In metal shelter.

† In concrete house.

Laboratory sample analysis

The MRD Soils Laboratory analyzed the samples for suspended-sediment concentration and bed-material particle-size distribution, using the methods outlined in References 6-8.

Data reduction procedures

The OD computed sediment load (tons/day) from the suspended-sediment concentration reported from the laboratory analyses and the discharge. The data reduction procedure was automated in 1965 using the Kansas City District load program (Reference 9).

Data reporting procedures

Suspended-sediment load were published by the OD in Reference 11. Figure A96 is an example of these data. Discharge data were published in Reference 12 prior to 1961 and in References 13 and 38 since 1961.

General information

Sediment records for this station are considered to be good, with the possible exception of the samples taken with the Omaha sampler. The nozzle on this sampler is in the shape of a right angle, and the intake was positioned perpendicular to the streamflow during the sampling procedure. There is some question as to whether or not the larger sediment could follow the streamlines at the nozzle intake.

Additional information on this station can be obtained from: U. S. Army Engineer District, Omaha, Hydrologic Engineering Branch, Water Quality and Sediment Section, Federal Building, Omaha, Nebraska 68102.

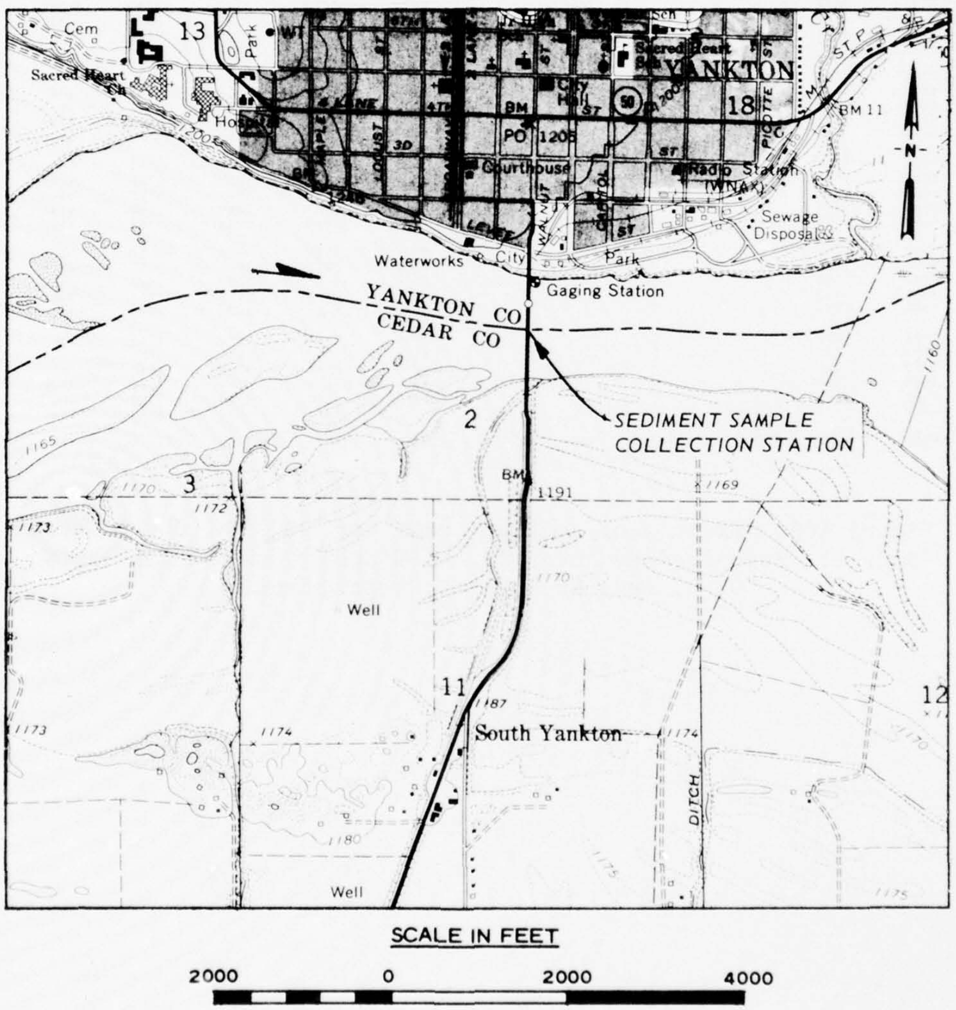

Figure A95. Site location for Yankton, South Dakota, sediment sample collection station (Source: USGS Quadrangle Map for Gavins Point Dam, Nebraska-South Dakota, 1968)

MISSOURI RIVER AT YANKTON, SOUTH DAKOTA 6-4675

MEASURED SUSPENDED SEDIMENT LOAD IN TONS — 1967 WATER YEAR

	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1	4250	4720					4550	4350	3170	3240	3180	3780
2	4320	4840					3730	4550	3100	3120	3310	3390
3	4340	4690					3560	4770	3050	3260	3020	2910
4	4070	4430					3330	4940	3430	3280	2850	2420
5	3510	4200					2930	4900	2700	3380	2270	2300
6	3530	4050					3250	4760	2500	3370	3300	2790
7	3530	3050					3470	4410	2290	3440	3300	2790
8	3610	3250					3520	4220	2340	3450	3370	2820
9	3670	3630					3720	4130	2330	3260	3540	2830
10	3450	4120					3820	4250	2080	2700	3520	2920
11	3440	4380					3900	4150	3060	2430	3470	3320
12	4140	4120					4000	4180	2800	2420	3360	3790
13	4250	3940					3810	4110	2050	2530	3500	3760
14	4750	4150					3230	4250	1790	2680	3580	3420
15	5070	4260					3290	4250	1080	2770	3690	3350
16	6330	4510					3650	4320	1080	2860	3780	3450
17	8730	4750					3970	4260	1020	2790	4180	3640
18	9620	5050					4200	3690	1260	3120	4450	3650
19	8740	5410					4580	3950	2410	3500	4370	3640
20	6180	5380					4740	3960	2930	3730	4390	3920
21	4590	5700					4910	3870	3300	3610	4320	4090
22	4150	5290					4480	3770	3500	3620	4010	4150
23	3740	3730					4160	3670	3290	3860	3960	4150
24	3540	2410					4230	3910	3400	3960	3960	4260
25	3090	1650					4250	4160	3220	3800	4100	4260
26	2990	1200					4250	4510	3440	3740	3340	3790
27	2920	730					4120	4560	3270	3560	3830	3330
28	3060	510					4250	4580	3200	3530	3910	3730
29	3110	350					4270	4110	3350	3560	3790	4230
30	3650	270					4280	3400	3350	3310	3860	4350
31	4500							4010		3150	3840	
	138860	108770	20200	16400	7600	65500	116450	130970	82290	101030	114550	105230

YEARLY TOTAL 1,009,900

Figure A96. Example of sediment data for Yankton, South Dakota (Source: Suspended Sediment in the Missouri River, 1965-1969, U. S. Army Engineer District, Omaha)

Nishnabotna River at Hamburg, Iowa

Station identification

OWDC No.: 06760

Agency station No.: 06810000

Latitude/longitude: 403757/953732

Agency reporting to OWDC: CE

River mile: 11.0 (Mile 0 is at the confluence of the Nishnabotna and the Missouri rivers; established by the CE in 1939.)

Site description

From 1939 to 1951, the station was on the Burlington Northern Railroad bridge, which crosses a relatively straight reach of the Nishnabotna River, 2 miles northeast of Hamburg, Iowa, and 1.5 miles downstream from the confluence of the east and west forks of the Nishnabotna (Figure A97). This stream is not navigable for commercial traffic. There is no bank protection, and frequent bank sloughing occurs. The streambed material consists of silt and fine sands, and the gradient through this reach is approximately 0.8 ft/mile. Sediment samples were occasionally taken from the U. S. Highway 275 Bridge, which crosses the Nishnabotna at Hamburg. The land upstream is used almost exclusively for agriculture. Annual soil loss due to erosion upstream from the station is 3,000-6,000 tons/square mile. There are no important diversions or storages of water above this station. The discharges of record (from 1928 to 1951) are: maximum - 55,000 cfs; mean - 896 cfs; and minimum - 4.5 cfs. The sediment loads of record are: maximum - 6,520,000 tons/day; mean - 38,500 tons/day; and minimum - 0 ton/day.

Station chronological record

The sediment sample collection station was established by the CE Omaha District (OD) in April 1939 as part of a program to study the feasibility of establishing sediment control structures in the Nishnabotna Valley. The resulting study showed that because of the heavy sediment load of the Nishnabotna, sufficient area for a reservoir that would act as an effective sediment trap (for a design life of 100 years) was not

available. The OD determined in 1951 that the sediment regime in this segment of the Nishnabotna was sufficiently well defined, and thus, the sediment sample collection station was closed in September 1951. During the period of operation, the samples were collected by the OD, and the data from the laboratory analyses were reduced and published by the same office. Laboratory analysis of the samples was conducted by the CE Missouri River Division (MRD) Soils Laboratory at Omaha.

Sample and data
collection procedures

Samples were collected weekly by the OD from 1 April 1939 through 30 September 1951. During the periods of low flow, surface samples were taken with a milk bottle. During periods of high flow, point samples were taken with an Omaha sampler on one to three verticals. The points on the verticals were determined by Luby Tables; the horizontal spacings between verticals were determined by the equal-discharge-rate method. Collection procedures are described in Reference 1a. River stage was measured using a wire-weight gage from 1928 to 1948 and a Stevens A-35 recorder from 1948 to 1951.

Laboratory sample analysis

The MRD Soils Laboratory analyzed the samples for suspended-sediment concentration using the methods outlined in References 6-8.

Data reduction procedures

Suspended-sediment load (tons/day) and discharge were tabulated daily. During low flows, the daily sediment load and discharge were estimated from relations prepared for this site. Hydrographs were prepared for the site to estimate sediment load and discharge during high flows.

Data reporting procedures

Suspended-sediment load (Reference 11) and discharge (Reference 12) were published on a daily basis from 1 April 1939 through 30 September 1951. Figure A98 shows an example of the data reported for this station.

General information

Sediment records for this station are considered to be fair, with

the possible exception of those samples taken during periods of heavy ice flow or backwater from the Missouri River. The validity of the samples taken with the Omaha sampler is subject to some question. The nozzle on this sampler is in the shape of a right angle, and the intake is positioned perpendicular to the streamflow during the sampling procedure. There is some question as to whether the larger sediment could follow the streamlines at the nozzle intake.

Additional information on this station can be obtained from: U. S. Army Engineer District, Omaha, Hydrologic Engineering Branch, Water Quality and Sediment Section, Federal Building, Omaha, Nebraska 68102.

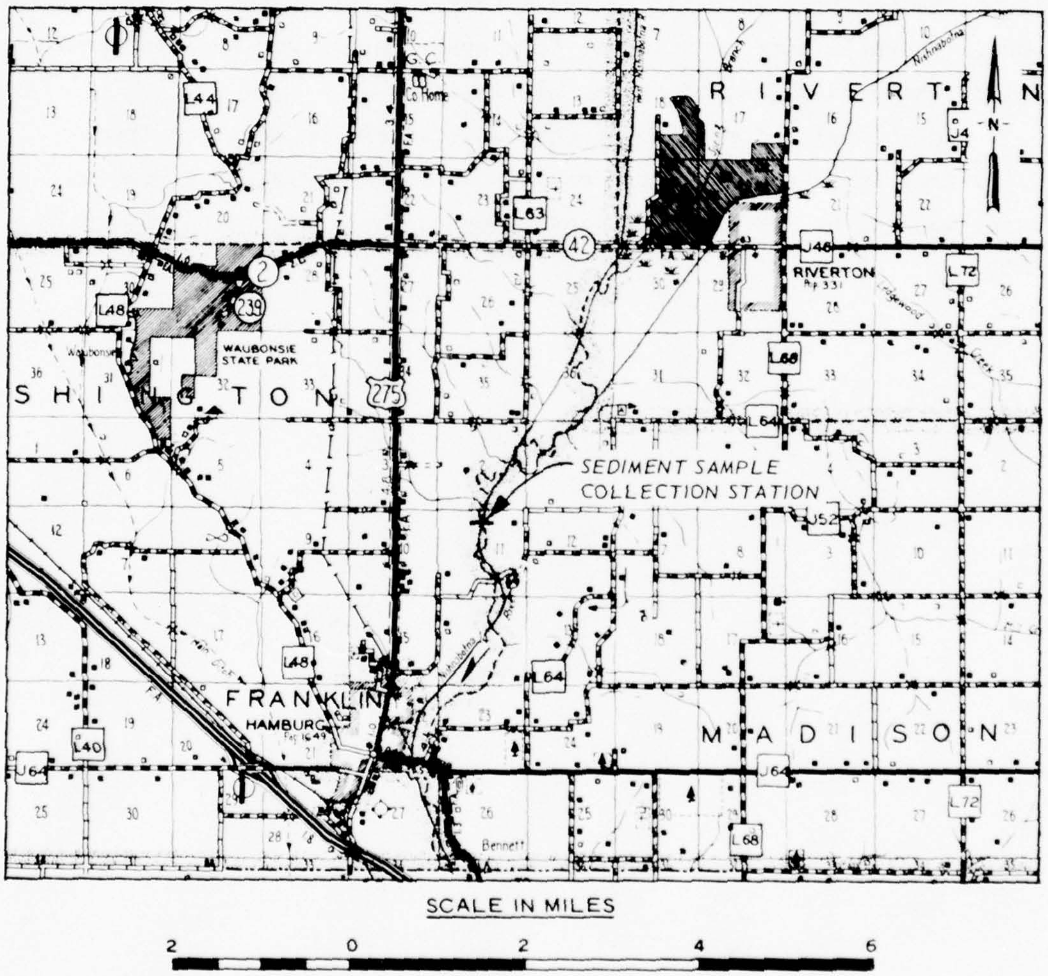

Figure A97. Site location for Hamburg, Iowa, sediment sample collection station (Source: General Highway and Transportation Map, Fremont County, Iowa, Iowa Department of Transportation, Des Moines, Iowa, 1974)

NISHNABOTNA RIVER near HAMBURG, IOWA

SUSPENDED SEDIMENT LOAD-TONS — Water Year Oct. 1949 - Sept. 1950

1	100	110	47	310	110	65,800	180	160	8,420	320	2,000	180
2	100	86	42	270	130	29,300	160	160	3,480	210	420	150
3	110	59	47	230	150	14,500	390	150	2,050	350	330	100
4	230	53	48	190	190	8,260	1,190	170	65,900	390	310	89
5	15,400	53	48	170	250	46,200	330	56,700	22,600	390	310	76
6	6,030	52	42	150	330	33,500	600	29,400	2,820	410	280	73
7	3,150	53	30	150	580	5,920	180	7,880	930	400	450	73
8	2,220	58	17	150	6,470	1,640	160	8,480	1,190	470	81,100	73
9	1,900	66	260	150	69,400	720	140	380,000	344,000	580	6,610	73
10	1,460	53	320	130	27,000	530	140	627,000	18,400	690	2,090	2,180
11	960	53	130	130	17,000	370	140	122,000	3,330	1,470	1,370	760
12	430	53	52	130	9,930	280	140	36,200	1,410	422,000	285,000	190
13	230	52	76	130	5,520	230	120	14,600	212,900	83,100	58,900	130
14	150	36	180	130	2,720	240	120	7,290	397,000	10,400	11,500	130
15	130	20	350	130	2,720	790	120	4,910	92,700	2,110	92,600	130
16	110	61	210	130	2,040	2,760	110	3,180	25,700	63,600	51,800	130
17	110	120	250	130	2,570	5,860	100	2,720	15,300	237,000	16,400	130
18	140	100	250	130	2,380	7,870	89	2,450	9,890	56,400	11,000	130
19	150	45	160	130	1,290	4,320	84	2,350	456,000	20,500	5,950	150
20	200	44	110	130	1,400	2,140	84	5,440	163,000	13,000	2,550	2,530
21	7,820	53	110	130	2,720	2,000	78	9,690	20,500	7,510	920	6,460
22	7,710	67	130	130	3,580	2,170	72	1,810	5,610	2,500	510	980
23	1,810	86	220	130	4,080	12,000	59	1,230	3,590	870	460	340
24	540	72	280	130	3,850	47,100	54	1,560	70,800	520	340	210
25	270	53	250	130	3,490	18,000	62	504,000	67,400	500	310	120
26	170	58	220	100	2,720	4,100	85	255,000	13,600	470	220	68
27	120	72	150	83	2,180	1,780	100	77,100	4,800	430	2,480	57
28	110	72	110	83	37,300	1,200	130	30,800	2,810	400	14,900	120
29	100	72	120	83		840	160	38,600	2,750	390	5,950	1,020
30	98	71	150	110		320	180	20,700	2,690	420	420	1,210
31	100		140	110		320		12,800		67,200	210	
	52,158	1,903	4,569	4,419	212,200	321,260	5,557	2,274,530	2,041,570	1,001,000	657,690	18,062

Yearly Total 6,594,918 Tons

a. Sediment data (Source:, Suspended Sediment in the Missouri River, 1949-1954, U. S. Army Engineer District, Omaha, Omaha, Nebraska)

Discharge, in second-feet, water year October 1949 to September 1950

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	d31	41	38	40	25	2,220	93	88	142	81	103	59
2	d31	41	45	40	25	520	90	77	130	70	79	56
3	36	41	43	40	25	390	88	70	384	90	74	54
4	36	41	35	40	*25	698	88	65	213	84	160	50
5	33	41	31	40	25	2,900	83	919	149	74	149	46
6	31	41	31	40	176	1,130	79	752	109	62	121	39
7	28	41	30	35	439	343	79	263	99	48	140	36
8	188	39	29	35	2,120	194	81	301	84	65	188	21
9	132	39	28	35	3,650	194	79	5,470	d258	58	153	41
10	104	39	27	35	1,460	170	76	1,210	117	48	136	36
11	87	38	30	35	648	150	74	565	88	313	121	28
12	94	52	32	*35	490	140	70	447	76	432	404	23
13	90	46	35	35	505	140	62	362	811	432	123	19
14	75	43	40	35	128	160	62	343	2,070	188	172	16
15	57	43	41	35	110	232	58	294	795	158	156	16
16	d50	35	42	35	100	260	58	258	520	729	115	33
17	46	24	42	30	90	327	56	228	324	626	93	22
18	d40	35	43	30	90	390	56	216	3,260	297	84	14
19	38	46	43	30	142	248	52	245	2,780	263	113	10
20	33	39	71	30	462	153	46	248	a648	d276	81	10
21	325	35	60	30	752	169	46	238	a376	286	60	23
22	174	25	56	30	505	160	47	218	a303	165	62	d40
23	119	25	*54	30	263	603	43	192	815	123	58	d37
24	61	25	50	30	252	520	39	181	668	109	53	34
25	55	38	50	30	228	300	62	994	303	211	46	d34
26	50	52	50	30	228	273	67	630	213	162	43	d33
27	46	41	45	25	228	211	64	308	162	136	43	33
28	52	41	45	25	4,430	169	65	278	136	121	172	29
29	59	39	45	25	-	117	69	248	123	97	109	36
30	50	38	45	25	-	107	343	232	115	67	84	48
31	41	-	45	25	-	101	-	228	-	119	65	-

* Winter discharge measurement made on this day.
a No gage-height record; discharge interpolated.
d Doubtful gage-height record.

b. Discharge data (Source: Surface Water Supply of the United States 1950, Part 6, USGS, Washington, D. C.)

Figure A98. Example of data for Hamburg, Iowa

Nishnabotna River (East Fork) at Red Oak, Iowa

Site identification

OWDC No.: 52032

Agency station No.: 06809500

Latitude/longitude: 410041/951407

Agency reporting to OWDC: USGS

River mile: 37.9 (Mile 0 is at the confluence of the East and West Nishnabotna rivers; established by the USGS in October 1962.)

Site description

From October 1962 to September 1973, the station was in the center of the Coolbaugh Street Bridge, which crosses the East Nishnabotna River at Red Oak (Figure A99). The station is in a straight reach of the river, and the gradient through this reach is 4.67 ft/mile. The bed material is sandy, and the stream is not navigable for commercial traffic. This reach is regulated for at least 1.5 miles above and 0.5 mile below the station. The station is at the downstream end of flood control works, consisting of dikes and levees to protect the city of Red Oak. Annual soil loss due to erosion upstream from the station is 3,000-6,000 tons/square mile. The discharges of record (1918-1924, 1936 to the present) are: maximum - 38,000 cfs; mean - 374 cfs; and minimum - 6 cfs. The sediment loads of record (October 1962 - September 1973) are: maximum - 970,000 tons/day; mean - 6,238 tons/day; and minimum - 0.4 ton/day.

Station chronological record

The sediment station was established in October 1962 by the USGS Iowa District to collect samples on the east fork of the Nishnabotna. Its operation was funded by the Iowa Geological Survey (state agency). The station was in a loessial soil area subject to heavy erosion during storm events. Another station was established on the west fork at Randolph, Iowa.

The Red Oak station was closed in September 1973. During the

period of record, the USGS Iowa District collected and analyzed the samples and reduced and reported the resulting data.

Sample and data
collection procedures

Collection of sediment samples was begun on 1 October 1962. The observer collected daily sediment samples during normal flow periods and at more frequent intervals during high flows. All samples were depth-integrated and obtained with either a US D-43 sampler (75 percent) or a brass bucket (25 percent). The brass bucket was used to obtain samples during the winter. One bottle was obtained for each sample, except for some high flows when two-bottle samples were collected. Temperature and conductivity observations were made on all samples. The US D-43 sampler was in a metal shelter in the center of the Coolbaugh Street Bridge.

The USGS Iowa District began gaging in the vicinity of Red Oak on 22 May 1918 and discontinued its operation on 5 July 1925. This agency resumed gaging operations on 29 May 1936. The following tabulation summarizes the gaging and recording devices used at Red Oak on the Coolbough Street Bridge during the period of record:

Period	Locality	Device Used
22 May 1918 - 4 July 1925	Mile 37.9	Chain gage
29 May 1936 - 12 May 1966	Mile 38.4	Canfield wire-weight gage
29 July 1939 - 12 May 1966	Mile 38.4	Water-stage recorder
22 March 1951 - 14 November 1952	Mile 38.4	Canfield wire-weight gage
13 May 1966 - present	Mile 37.9	Type A wire-weight gage
13 May 1966 - present	Mile 37.9	Stevens A-35 water-stage recorder (driven by manometer)
13 May 1966 - present	Mile 37.9	Digital punch-tape water-stage recorder*

* With attachment that enables query by National Weather Service by means of telephone.

Laboratory sample analysis

Information is identical to that presented for the Cedar River sediment sample collection station at Cedar Rapids, Iowa.

Data reduction procedures

The concentrations obtained at the station were plotted on the gage-height chart, and a smooth concentration curve was drawn between the points; the average was used as the mean daily concentration. The daily sediment loads were computed by multiplying the product of the mean daily discharge and the mean concentration by 0.0027 to convert to tons per day. On 16 days of rapidly changing water discharge and concentration, the graphs were subdivided and the total sediment discharge for the day was computed by averaging sediment discharge for appropriate intervals of a day.

Sediment computations for the water year were computed using the WRD sediment computer program W-4252.

Data reporting procedures

Sediment data were published in Reference 14. Discharge data were published in Reference 12 prior to 1961 and in Reference 15 since that date. Figure A100 shows a sample of data reported from this station.

General information

Records are good except those for the winter period, which are poor. Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

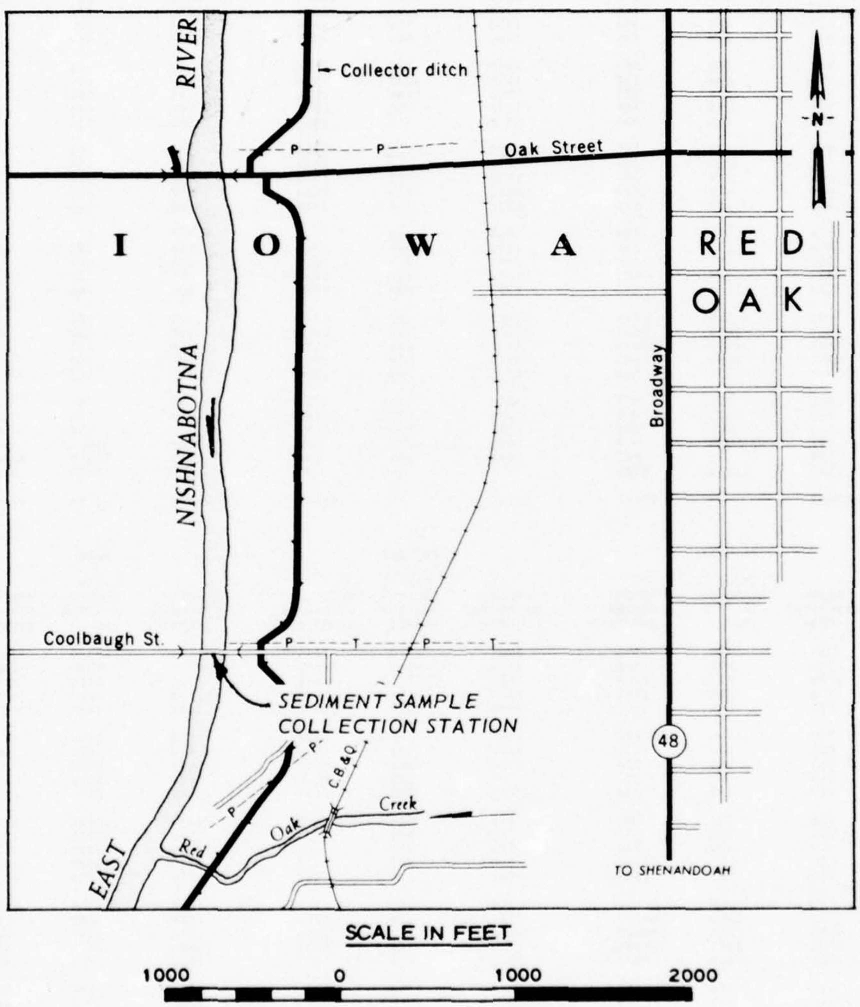

Figure A99. Site location for Red Oak, Iowa, sediment sample collection station (Source: Project Maps, Omaha District, Part II Flood Control Projects, Map No. 48, U. S. Army Engineer District, Omaha, Omaha, Nebraska, 1974)

NISHNABOTNA RIVER BASIN

06809500 EAST NISHNABOTNA RIVER AT RED OAK, IOWA

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCEN-TRATION (MG/L)	OCTOBER SEDIMENT DISCHARGE (TONS/DAY)	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCEN-TRATION (MG/L)	NOVEMBER SEDIMENT DISCHARGE (TONS/DAY)	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCEN-TRATION (MG/L)	DECEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	796	466	1000	1430	1440	5560	1080	259	755
2	707	300	573	2260	2500	15300	1080	391	1140
3	647	267	466	1770	2160	10300	1070	405	1170
4	627	268	454	1330	852	3060	800	203	438
5	601	259	420	1210	868	2840	700	162	306
6	572	262	405	1150	798	2480	650	65	114
7	558	240	362	1550	1030	4310	620	124	208
8	538	258	375	1550	1160	4850	600	153	248
9	516	240	334	1270	655	2250	580	141	221
10	485	204	267	1320	675	2410	560	130	197
11	471	199	253	1390	900	3380	540	121	176
12	460	213	265	1210	574	1880	520	119	167
13	441	217	258	1220	580	1910	500	113	153
14	440	176	209	1420	738	2830	508	110	149
15	430	153	178	1500	716	2900	500	108	146
16	410	139	154	1410	568	2160	500	110	149
17	416	130	146	1350	482	1760	500	141	190
18	391	151	159	1330	449	1610	520	142	199
19	380	124	127	1310	418	1480	520	133	187
20	381	139	143	1260	388	1320	520	146	205
21	430	315	366	1180	353	1120	540	127	185
22	551	2040	3030	1170	337	1060	540	131	191
23	1400	2400	9070	1130	450	1370	560	120	181
24	1340	2050	7420	1130	510	1560	560	117	177
25	918	755	1870	1200	424	1370	580	113	177
26	812	421	923	1380	463	1730	600	111	180
27	753	373	758	1280	345	1190	650	130	228
28	690	400	745	1180	327	1040	700	175	331
29	653	385	679	1090	280	824	2500	3610	24400
30	735	420	833	1080	255	744	6610	13600	246000
31	1140	1210	3720	--	--	--	2270	5980	44100
TOTAL	19689	--	35962	40060	--	86598	28970	--	322668

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCEN-TRATION (MG/L)	JANUARY SEDIMENT DISCHARGE (TONS/DAY)	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCEN-TRATION (MG/L)	FEBRUARY SEDIMENT DISCHARGE (TONS/DAY)	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCEN-TRATION (MG/L)	MARCH SEDIMENT DISCHARGE (TONS/DAY)
1	1530	880	3640	2960	6870	81200	3130	10300	104000
2	1980	895	4780	3980	6510	86800	2010	4320	23400
3	1190	733	2360	1670	1870	8430	1510	2810	11500
4	900	750	1820	1610	1790	7780	1410	1860	7080
5	800	1550	3350	1970	2240	11900	1440	1480	5750
6	700	1100	2080	1500	1560	6320	1730	1940	9060
7	650	1330	2330	1170	970	3060	1810	1650	8060
8	600	360	583	850	568	1300	1450	1370	5360
9	570	141	217	760	523	1070	1400	1610	6090
10	570	138	212	740	552	1100	1638	2950	13000
11	570	182	280	720	500	972	2390	10600	68400
12	570	180	277	720	475	923	2150	3950	22900
13	570	498	766	720	492	956	2000	2810	15200
14	600	680	1100	700	388	733	3768	10100	103000
15	700	553	1050	500	350	473	1550	5550	23200
16	900	680	1650	350	317	300	1610	2580	11200
17	3000	6920	56100	1500	110	446	1720	1600	7430
18	5570	9300	140000	1830	72	356	1570	1620	6870
19	1770	3380	16200	1790	398	1920	1490	1220	4910
20	1110	1600	4800	1320	515	1840	1400	1070	4040
21	924	910	2270	1840	3130	15500	1300	808	2840
22	812	608	1330	1210	1910	6240	1250	775	2620
23	750	448	907	2200	5860	34800	1240	675	2260
24	750	427	865	2360	10200	65000	1380	1270	4730
25	761	698	1430	1790	10800	52200	1960	3530	18700
26	716	825	1590	1440	2730	10600	2200	3410	20300
27	731	1320	2610	1090	1250	3680	1800	1610	7820
28	786	1420	3010	986	825	2200	1680	1210	5490
29	775	580	1210	--	--	--	1650	980	4370
30	812	1000	2190	--	--	--	1570	795	3370
31	755	625	1270	--	--	--	3360	6740	83900
TOTAL	33422	--	262277	40276	--	408099	56550	--	616850

Figure A100. Example of discharge and sediment data for Red Oak, Iowa (Source: Water Resources Data for Iowa, 1973, USGS, Iowa City, Iowa) (sheet 1 of 2)

NISHNABOTNA RIVER BASIN

06809500 EAST NISHNABOTNA RIVER AT RED OAK, IOWA--CONTINUED

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCEN-TRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCEN-TRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCEN-TRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)
1	4190	4210	51100	1880	2030	10300	1720	850	3950
2	3010	3620	29400	2390	2940	20000	1560	910	3830
3	2560	2510	17300	2090	3070	18100	1510	890	3630
4	2150	1820	10600	1640	1360	6020	1440	790	3070
5	1880	1420	7210	1530	1030	4250	2950	4680	39600
6	1720	1530	7110	1650	1160	5170	1640	2530	11200
7	1620	1520	6650	5710	5080	112000	1400	1050	3970
8	1530	1260	5210	10600	10800	319000	1270	767	2630
9	1570	945	4010	4710	4880	62100	1150	590	1830
10	1060	860	2460	4080	3200	35300	1060	588	1680
11	1840	1880	9340	3310	2350	21000	992	550	1470
12	2980	2940	23700	2620	1620	11500	943	538	1370
13	2550	2280	15700	2270	1600	9810	982	621	1650
14	2240	2040	12300	2030	1200	6580	950	648	1660
15	2570	2600	18000	1860	963	4840	929	595	1490
16	5610	9830	152000	1710	907	4190	928	412	1030
17	3730	4400	44300	1540	794	3300	851	478	1100
18	2650	2360	16900	1450	695	2720	962	2600	8170
19	2260	1880	11500	1370	666	2460	2040	11700	68600
20	2200	2000	11900	1250	588	1980	1020	4200	11600
21	1890	1980	10100	1190	558	1790	860	1150	2670
22	1660	1440	6450	1170	612	1930	785	342	725
23	1560	890	3750	1160	643	2010	750	330	668
24	1490	840	3380	1050	517	1470	700	418	790
25	1540	1640	6820	1010	451	1230	652	508	894
26	1920	2500	13000	979	408	1080	648	438	766
27	1540	1260	5240	1900	2100	10800	630	330	561
28	1420	1060	4060	4060	2700	29600	597	278	448
29	1370	925	3420	3130	2180	18400	559	311	469
30	1500	2450	9920	2360	1310	8350	544	382	561
31	--	--	--	1940	1050	5500	--	--	--
TOTAL	65810	--	522830	75639	--	742780	33022	--	182082

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCEN-TRATION (MG/L)	JULY SEDIMENT DISCHARGE (TONS/DAY)	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCEN-TRATION (MG/L)	AUGUST SEDIMENT DISCHARGE (TONS/DAY)	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCEN-TRATION (MG/L)	SEPTEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	728	800	1570	671	1720	3120	388	700	733
2	5440	12100	181000	574	669	1040	370	402	402
3	2250	4070	29100	492	502	667	348	319	300
4	5080	11600	192000	476	459	590	300	194	157
5	2380	8980	62700	370	422	422	284	135	104
6	1480	2420	9670	345	286	266	262	92	65
7	1070	1210	3500	374	282	285	253	91	62
8	965	890	2320	537	708	1030	250	112	76
9	900	700	1700	949	2140	6420	284	190	146
10	1180	2970	12700	997	3700	10600	381	312	321
11	1180	5200	17900	1190	2940	15800	338	231	211
12	813	1570	3450	1670	3440	18700	294	184	146
13	765	782	1620	720	860	1670	287	165	128
14	825	1000	2230	545	477	702	290	132	103
15	654	618	1090	541	453	662	290	129	101
16	605	492	804	440	351	417	287	205	159
17	560	418	632	472	353	450	287	388	301
18	524	399	565	537	425	616	284	283	217
19	516	490	683	338	283	258	247	152	101
20	960	2530	7760	287	262	203	226	135	82
21	1140	1760	5420	241	220	143	211	134	76
22	900	1080	2620	211	211	120	202	120	65
23	785	645	1370	235	224	142	188	103	52
24	705	577	1100	307	167	138	180	89	43
25	700	516	975	244	174	115	229	181	112
26	639	355	612	232	198	124	3340	18700	139000
27	570	375	577	194	175	92	2860	22700	199000
28	516	408	568	295	138	110	1120	5400	16300
29	472	383	488	307	111	92	925	655	1640
30	1480	3390	24200	290	97	76	800	210	454
31	1270	5910	21900	300	135	109	--	--	--
TOTAL	38052	--	592824	15381	--	65179	16005	--	360657

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 462876

TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 4198806

Figure A100 (sheet 2 of 2)

Nishnabotna River (West Fork) at Randolph, Iowa

Station identification

OWDC No.: 56921

Agency station No.: 068085800

Latitude/longitude: 405223/953448

Agency reporting to OWDC: USGS

River mile: 16.2 (Mile 0 is at the confluence of the East Nishnabotna and West Nishnabotna rivers; established by the USGS in 1965.)

Site description

From 1965 to 1973, the station was in the center of State Highway 184 Bridge crossing the West Nishnabotna River, 0.3 mile downstream from Deer Creek and 0.5 mile west of Randolph, Iowa (Figure A101). The land upstream is used almost exclusively for agriculture, and there is no industry in the area. The streambed in the vicinity of the station is shallow with small willows growing along the unprotected banks. The stream is not navigable for commercial traffic in this reach. The streambed material is composed of fine silty sand, and the gradient through this reach is 4.78 ft/mile. Annual soil loss due to erosion upstream from the station is 3000-6000 tons/square mile. The discharges of record (1948 to the present) are: maximum - 35,500 cfs; mean - 550 cfs; and minimum - 10 cfs. The sediment loads of record (1965-1973) are: maximum - 717,000 tons/day; mean - 24,650 tons/day; and minimum - 1.3 tons/day.

Station chronological record

The sediment station was established in 1965 by the USGS Iowa District to collect sediment samples on the west fork of the Nishnabotna. (A station was also established on the east fork at Red Oak, Iowa.) During the period of record, the USGS Iowa District collected and analyzed the samples and reduced and reported the resulting data. The station was closed in 1973.

Sample and data collection procedures

The USGS collected one- or two-bottle samples periodically (approximately once a month) with a US D-43 sampler (Reference 1a).

The gaging station at Randolph was established on 3 June 1948 at the same location as the sediment sample collection station (mile 16.2). The following tabulation presents the gaging and recording devices used at Randolph during the period of record:

Period	Device Used
3 June 1948 - present	Type A wire-weight gage
30 June 1949 - 26 August 1955	High-water recorder at downstream end of left pier
27 August 1955 - 5 August 1971	Water-stage recorder at downstream end of left pier (driven by float)
6 August 1971 - present	Stevens A-35 water-stage recorder (driven by manometer)
6 August 1971 - present	Digital punched-tape recorder (driven by manometer)*

* With attachment that enables query by National Weather Service by means of telephone.

Laboratory sample analysis

Information identical to that presented for the Cedar River sediment sample collection station at Cedar Rapids, Iowa.

Data reduction procedures

Information identical to that presented for the Boyer River sediment sample collection station at Logan, Iowa.

Data reporting procedures

Daily discharge has been published by the USGS on a daily basis since 1948. Prior to 1961, these data were published in Reference 12, and since that date, they have been published in Reference 15. Suspended-sediment loads were reported in Reference 14. Figure A102 shows a sample of data reported for this station.

General information

The sediment records are considered good, except for the winter period, which are poor. Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

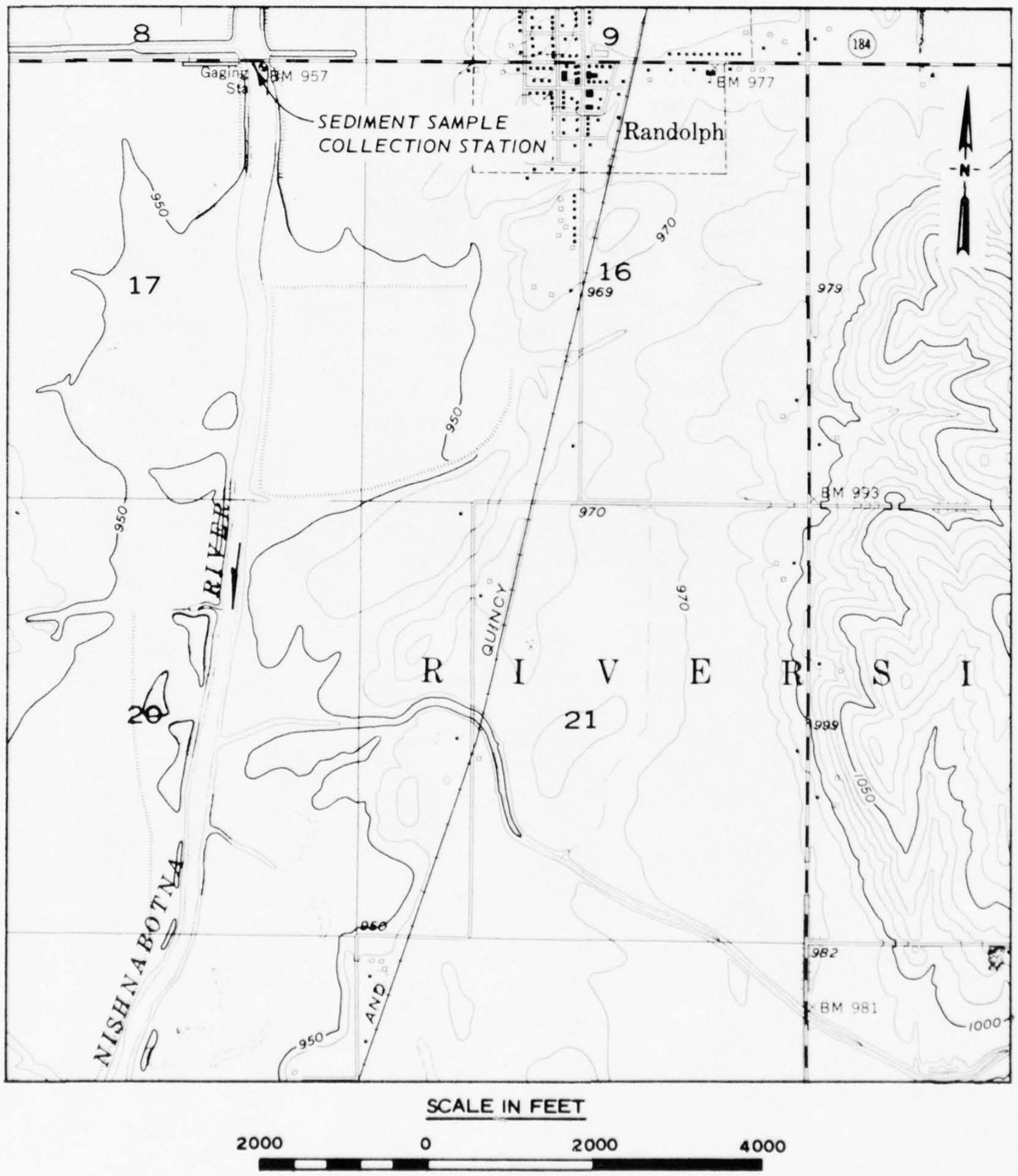

Figure A101. Site location for Randolph, Iowa, sediment sample collection station (Source: USGS Quadrangle Map for Randolph, Iowa, 1957)

NISHNABOTNA RIVER BASIN

06808500 - WEST NISHNABOTNA RIVER AT RANDOLPH, IOWA (LAT 40 52 23 LONG 095 34 48)

DATE	TEMPER-ATURE (DEG C)	DIS-CHARGE (CFS)	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)
OCT., 1972				
06...	14.0	595	265	426
20...	5.0	410	157	174
DEC.				
20...	.0	832	197	443
JAN., 1973				
18...	1.5	7530	10500	213000
31...	1.0	989	886	2370
FEB.				
22...	2.0	1780	3080	14800
26...	1.5	1860	4610	23200
MAY				
23...	18.0	1640	604	2680
JUNE				
21...	22.0	1240	826	2770
JULY				
24...	20.5	1400	375	1420
AUG.				
21...	26.0	640	412	712
SEP.				
21...	22.5	504	245	333

Figure A102. Example of sediment data for Randolph, Iowa (Source: Water Resource Data for Iowa, 1973, USGS, Iowa City, Iowa)

Nodaway River near Burlington Junction, Missouri

Station identification

OWDC No.: 63482

Agency station No.: 06817500

Latitude/longitude: 402642/950519

Agency reporting to OWDC: CE

River mile: 71.6 (Mile 0 is at the confluence of the Nodaway and Missouri rivers, mile 462.3 of the Missouri River; established by the CE in 1969.)

Site description

The station is on U. S. Highway 136 Bridge crossing the Nodaway River, 0.5 mile upstream from Mill Creek, 0.5 mile downstream from Norfolk and Western Railroad bridge, and 1.5 miles west of Burlington Junction, Missouri (Figure A103). Upstream from this station is a broad floodplain used almost exclusively for agriculture. The banks of the river are unprotected. The channel in this reach was straightened in the 1930's but is not navigable for commercial traffic. The streambed is sandy, and the channel gradient through this reach is 4.1 ft/mile. Annual soil loss due to erosion upstream from this station is 3,000-6,000 tons/square mile. The discharges of record (1922 to the present) are: maximum - 46,000 cfs; mean - 529 cfs; and minimum - 1.1 cfs. The sediment loads of record (1969 to the present) are: maximum - 612,553 tons/day; mean - 16,245 tons/day; and minimum - 1.0 ton/day.

Station chronological record

The sediment sample collection station was established by the CE Kansas City District (KCD) in October 1969 to monitor the sediment contribution of the Nodaway River to the Missouri River. Stage and discharge have been measured at this station since 1922. Sample collection and data reduction and presentation have been the responsibility of the KCD for the period of record. Sample laboratory analysis was handled by the KCD prior to May 1973 and by the CE Missouri River Division Soils Laboratory in Omaha, Nebraska, since that date to the present.

Sample and data
collection procedures

Samples have been collected by paid observers twice weekly from October 1969 to the present, with additional samples (approximately twice daily) taken during high flows. The sampling procedure consists of one depth-integrated vertical sample using a US D-49 sampler.

The USGS has been collecting stage data in the vicinity of Burlington Junction since 4 March 1922. The following tabulation summarizes the locations of the gaging and recording devices used by the USGS during the period of record:

Period	Locality	Device Used
4 March 1922 - 25 October 1928	Old U. S. Highway 136 Bridge (mile 71.6)	Chain gage
26 October 1928 - 9 June 1929	Railroad bridge (mile 72.1)	Chain gage
10 June 1929 - 6 December 1934	U. S. Highway 136 Bridge (mile 71.6)	Chain gage
7 December 1934 - present	U. S. Highway 136 Bridge (mile 71.6)	Canfield wire-weight gage
10 March 1939 - present	U. S. Highway 136 Bridge (mile 71.6)	Stevens A-35 water-stage recorder*
2 December 1953 - present	U. S. Highway 136 Bridge (mile 71.6)	Type A wire-weight gage
18 September 1970 - present	U. S. Highway 136 Bridge (mile 71.6)	Fisher-Porter automatic digital recorder

* During the period 13 March 1939-28 June 1939, this recorder was inoperable due to a flood, and the Canfield wire-weight gage was used.

Laboratory sample analysis

The information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

The information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Water discharge data have been recorded since 1922 and were

reported in Reference 12 prior to 1961 and in Reference 32 since 1961. Suspended-sediment load data have never been published; however, these data will be published in the near future.

General information

Discharge records are considered fair. Additional information on this station can be obtained from: U. S. Army Engineer District, Kansas City, Hydrologic Engineering Branch, Water Control Section, 700 Federal Building, 601 East Twelfth Street, Kansas City, Missouri 64106.

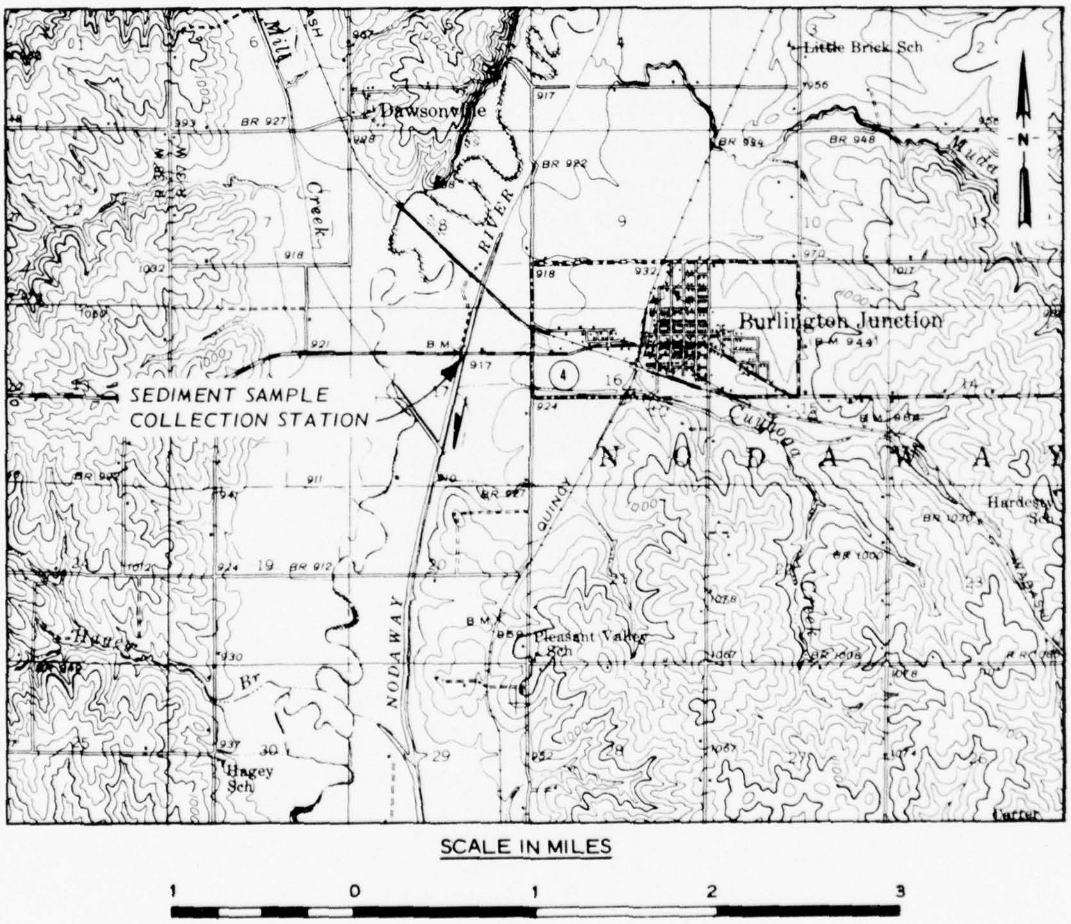

Figure A103. Site location for near Burlington Junction, Missouri, sediment-sample collection station (Source: USGS Quadrangle Map for Skidmore, Missouri, 1939)

Ohio River at Greenup Dam, Kentucky

Station identification

OWDC No.: 83933

Agency station No.: 03216600

Latitude/longitude: 383848/825138

Agency reporting to OWDC: USGS

River mile: 341.1 (Mile 0 is at the confluence of the Allegheny, Monongahela, and Ohio rivers, established by the CE in 1906.)

Site description

The station is beneath a large gas pipeline that crosses the Ohio River 2500 ft downstream from Greenup Dam, Kentucky (Figure A104). This station is 35 miles downstream from the mining and industrial areas of Ironton, Ohio; Ashland, Kentucky; and Huntington, West Virginia. Additionally, there is heavy strip-mining and industrial activity along the Big Sandy River, an important tributary entering the left bank of the Ohio River at mile 317.1; the Big Sandy River is the Kentucky-West Virginia state boundary. Heavy sediment loads in the Big Sandy River are causing its Fishtrap Reservoir to become filled far ahead of its design life. The bed material in this reach of the Ohio River is sand, and the approximate channel gradient is 0.5 ft/mile. Streambanks are unprotected, and there are no artificial levees. Discharges measured during the period of record (1 October 1968 to the present) are: maximum - 540,000 cfs; mean - 95,100 cfs; and minimum - 8,100 cfs. Water samples taken for determining chemical and biological constituents as well as sediment loads have been collected monthly since 22 October 1974, but sediment analyses were run only on four of the days during water year 1975. Daily suspended-sediment loads ranged from 2,260 tons/day to 32,000 tons/day for these four samples; it should be emphasized that no sediment analyses were made on water samples collected during low flows.

Station chronological record

This station was established in October 1974 as a part of the National Stream Quality Accounting Network (NASQUAN) to monitor changes

in the chemical and biological constituents, as well as sediment loads, in this reach of the river. Sample collection, bacteriological laboratory analysis, data reduction, and data publication are the responsibility of the USGS Kentucky District, Louisville, Kentucky. Sediment laboratory analysis is the responsibility of the USGS Ohio District, Columbus, Ohio; the USGS Central Laboratory, Doraville, Georgia, determines chemical and biological constituents.

Sample and data
collection procedures

Stream velocity measurements (used to compute discharge) are made monthly by the USGS Kentucky District personnel from a boat with a Price current meter along an established discharge range that parallels the large gas pipeline that crosses the Ohio downstream from Greenup Dam (Figure A104). One member of the field party walks along the pipe (100 ft above the Ohio River) and holds a rope attached to the bow of the boat; an anchor is dropped from the stern to keep the boat from drifting when measurements are made. These velocity measurements are made at 0.2 and 0.8 of the total depth on a varying number of verticals (at least 30, depending on river stage). Either the equal-discharge-increment (EDI) method or the equal-transit-rate (ETR) method is used to collect the water-quality samples along this range on at least three verticals. If the EDI method is used, the centroids of these verticals are positioned at 22.5, 50, and 77.5 percent of the maximum stream velocity; if the ETR method is used the verticals are positioned at 22.5, 50, and 77.5 percent of the distance across the stream. The EDI method has been used more often than the ETR method. A US P-61TM sampler* is used to collect separate 1-pt, depth-integrated samples on both ascending and descending trips on each vertical; the samples are then physically composited for analysis of chemical and biological constituents and sediment composition. Temperature and pH readings are taken for the composited samples. An additional grab sample is

* The "TM" suffix indicates that the sampler has been coated with epoxy material for accurate determination of trace metals.

collected in the center of the stream 1.5 ft below the water surface for bacteriological analysis; it is not composited with the depth-integrated samples. Sampling and velocity measurements are hindered by lockages at Greenup Dam, which have a great effect on the stream velocity profile in the vicinity of the station. Sampling personnel must either wait for the river to reach equilibrium after each lockage or sample at night when river traffic is minimal. During times of low flows, the water samples are taken by the open-bottle (or nozzleless) method, and only chemical and biological analysis are run. In the first year of operation of this NASQUAN station, sediment analyses were run on only four of the composited samples. The US P-61TM sampler as well as the EDI and ETR methods are discussed in Reference 1a.

A Stevens A-35 recorder is in the Greenup Dam gagehouse. This device continuously monitors the levels of both the headwater and the tailwater of the dam. There also are four Fisher-Porter automatic digital recorders that monitor the following parameters: (a) headwater (2hr intervals), (b) tailwater (2hr intervals), (c) number of lockages (one registration for the smaller 600-ft lock and two registrations for the larger 1200-ft lock), and (d) vertical gate openings (2-hr intervals, one value for all nine gates). From the beginning of the period of record (1 October 1968) through 30 September 1975, the gagehouse recorders were operated and maintained by the USGS West Virginia District; but from 1 October 1975 to the present, the operation has been the responsibility of the USGS Kentucky District.

Daily discharge is computed from the head, gate openings, and lockages. Flows are regulated by the Ohio River system of locks, dams, and reservoirs upstream from the dam.

Temperature and specific conductance samples are taken daily by observers (CE, Huntington District, Lock and Dam personnel) at abandoned Lock and Dam No. 30 (mile 339.4), 1.6 miles upstream from Greenup Dam. The specific conductance sample bottles are given to the USGS field team each month.

Laboratory sample analysis

Bacteriological determinations are made on the single grab sample

taken 1.5 ft below the water surface at the midpoint of the river on this range; the USGS Kentucky District is responsible for the laboratory work.

The physically composited depth-integrated water-quality samples are poured into separate bottles for the various other laboratory determinations. Bottles are filled and sent to the USGS Central Laboratory, Doraville, Georgia, for chemical and biological analysis, and to the USGS Ohio District, Columbus, Ohio, for sediment analysis (suspended-sediment concentrations and particle-size distributions). The methods used for the analysis of the sediment samples are discussed in Reference 1b.

Data reduction procedures

Sediment loads are computed from the suspended-sediment concentration values and the instantaneous discharge values for the days of sampling using the USGS Water Resources Division computer programs. These data are punched on computer cards and entered via a remote terminal in Louisville, Kentucky, to the USGS computers (IBM 370-155, units RE1 and RE2) in Reston, Virginia.

The USGS Central Laboratory in Doraville, Georgia, after analyzing the water samples for chemical and biological constituents, enters the values in the USGS Water-Quality Files and furnishes the Kentucky District with a printout. The Kentucky District has 15 days to check the laboratory data for suspicious results. These data are corrected as necessary by the Central Laboratory within the 15-day period, after which time they are transferred automatically to the Environmental Protection Agency's STORET system by USGS personnel in Reston, Virginia.

Data reporting procedures

All suspended-sediment concentrations and loads, the results of chemical and biological analyses, daily temperatures, and daily specific conductance values, are published annually in Reference 39. Figure A105 is an example of these data. Until water year 1975, discharge data were published in Reference 40; since 1975, these data have appeared in Reference 41.

Daily values (temperature, specific conductance, and discharge) are entered in the USGS WATSTORE files; and sediment, chemical, and

biological data are entered in the USGS Water-Quality Files and later transferred to the STORET System.

<u>General information</u>

The USGS cautions against using sediment data from this station with any degree of confidence, since the four published values taken over the first year of record cannot be said to be representative of anything typical in this reach of the Ohio River. The USGS also believes that bed load constitutes a more significant portion of the sediment load of the Ohio River than does sediment load, but it has no data to substantiate this belief. Even though there are little sediment data available for this station, it is anticipated that the station will be operational over a long period of time as part of the NASQUAN program and should provide a source for needed data in future years.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, Room 572, Federal Building, 600 Federal Place, Louisville, Kentucky 40202.

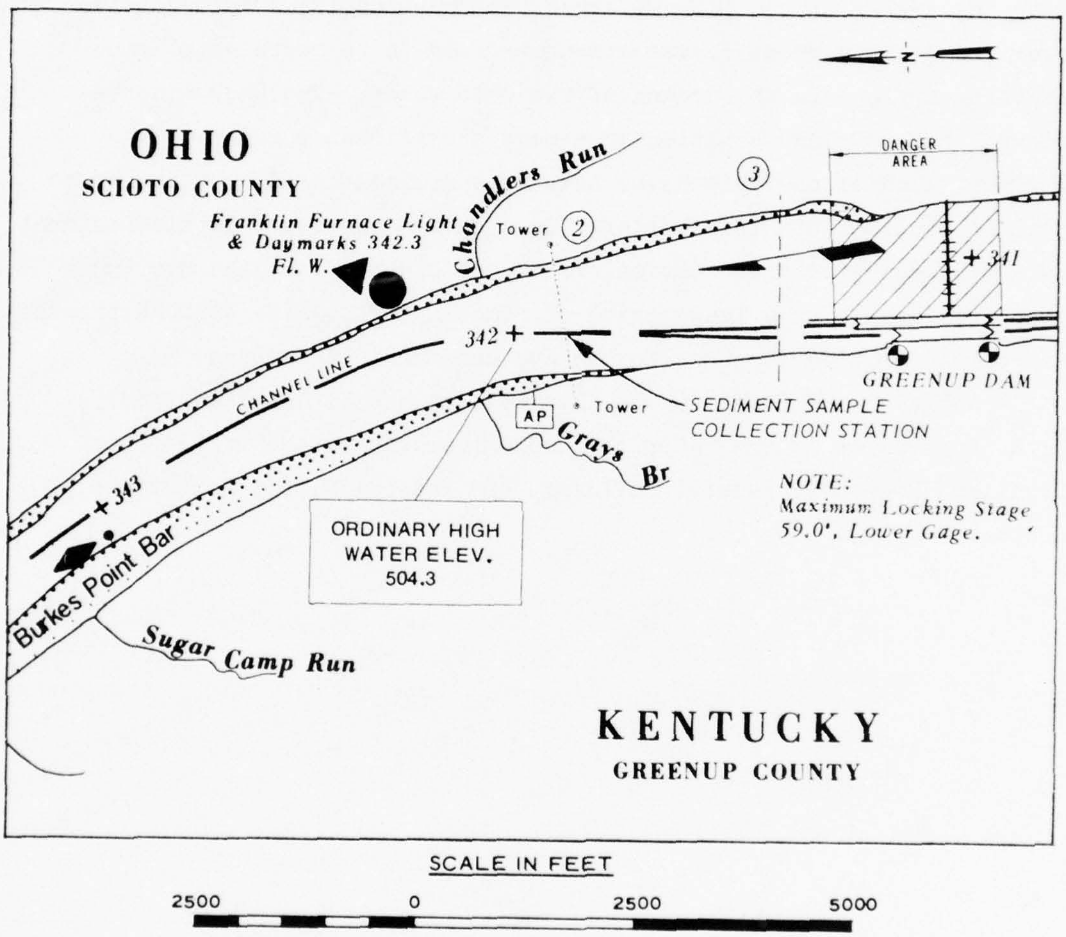

Figure A104. Site location for Greenup Dam, Kentucky, sediment sample collection station (Source: Chart No. 127, Ohio River Navigation Charts, Foster, Kentucky, to New Martinsville, Indiana, U. S. Army Engineer District, Huntington, Huntington, West Virginia, January 1975)

OHIO RIVER MAIN STEM

03216600 Ohio River at Greenup Dam, Ky.

WATER QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DATE	TOTAL PHYTO-PLANK-TON (CELLS PER ML)	FECAL COLI-FORM (COL. PER 100 ML)	STREP-TOCOCCI (COL-ONIES PER 100 ML)	TOTAL ORGANIC CARBON (C) (MG/L)	PERI-PHYTON BIOMASS ASH WEIGHT G/SQ M	PERI-PHYTON BIOMASS TOTAL DRY WEIGHT G/SQ M	UNCOR-RECTED PERI-PHYTON CHLORO-PHYLL A MG/SQ M	UNCOR-RECTED PERI-PHYTON CHLORO-PHYLL B MG/SQ M	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)	SUS. SED. SIEVE DIAM. % FINER THAN .062 MM
OCT.											
22...	2000	--	--	2.4	--	--	--	--	33	2260	81
NOV.											
19...	5100	--	--	--	3.1	--	.1	.4	19	2570	69
DEC.											
17...	2900	--	--	--	--	--	--	--	84	32400	86
JAN.											
17...	840	--	--	5.1	--	--	--	--	--	--	--
FEB.											
20...	560	8680	170	--	--	--	--	--	--	--	--
MAR.											
18...	760	8300	190	5.1	.00	.50	.1	.0	--	--	--
APR.											
22...	4100	240	88	--	--	--	--	--	--	--	--
MAY											
28...	2800	81100	90	--	2.1	3.2	.1	.0	47	11500	100
JULY											
08...	790	230	83	2.8	33	39	58	6.2	--	--	--
AUG.											
20...	3400	81900	--	--	--	--	--	--	--	--	--
SEP.											
17...	910	8870	830	--	16	19	42	10	--	--	--

Figure A105. Example of water-quality and sediment data for Greenup Dam, Kentucky (Source: Water Resources Data for Kentucky, 1975, USGS, Louisville, Kentucky)

Ohio River at Markland Dam, Kentucky

Station identification

OWDC No.: 50161

Agency station No.: 03277200

Latitude/longitude: 384629/845752

Agency reporting to OWDC: USGS

River mile: 531.5 (Mile 0 is at the confluence of the Allegheny, Monongahela, and Ohio rivers; established by the CE in 1906.)

Site description

The discharge and sediment sample collection station are downstream in the tailwater of Markland Dam (Figure A106). This is a high-water dam built to replace several smaller structures. Agriculture is practiced along both banks, but the left (or Kentucky) bank is generally less suited to this purpose than the right (or Indiana) bank. Cincinnati, Ohio, and the confluence of the Licking and Ohio rivers are 60 miles upstream. The Great Miami River enters the right bank of the Ohio River at mile 491.0 (near the Indiana-Ohio State line). Except for the Licking and Great Miami rivers, only a few minor tributaries enter the Ohio River between Cincinnati and Markland Dam. River traffic through Markland Locks is heavy, especially during the summer months. Both banks in this reach are unprotected, and there are no artificial levees. The streambed material is composed of sand, and the channel gradient through the reach is 0.4 ft/mile. The discharges measured at the Markland Dam gage during the period of record (May 1970 to the present) are: maximum - 465,000 cfs; mean - 130,500 cfs; and minimum - 10,500 cfs. The four suspended-sediment loads measured during the period of record (October 1974 to the present) ranged from 1,610 tons/day to 19,800 tons/day--it should be emphasized that no sediment analyses were run on samples collected during low flows.

Station chronological record

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky.

Sample and data
collection procedures

Information identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky, with the following exceptions:

a. Velocity and sediment measurements are taken by boat downstream from Markland Dam. Normally the equal-discharge-increment method is used to collect suspended-sediment samples. Samples collected during low flows are taken by the open-bottle (nozzleless) method, and no sediment analyses are run on these samples. Alignment at this station is more difficult than at Greenup Dam, since crew members must rely on landmarks on the bank rather than on an overhead pipeline; distances along the range are measured with a sextant. Flows at this station are greatly affected by lockages, and it is sometimes necessary to measure velocities and collect samples at night when the flow is stable.

b. Gaging records at Markland Dam, Kentucky, began in May 1970. Daily discharges are computed from the head, gate openings, lockages, and turbine flows. In the Markland Dam gagehouse are two Stevens A-35 recorders, driven by manometers, which monitor headwater and tailwater gage heights; these two instruments are owned by the CE Louisville District and maintained by the USGS Kentucky District. The Kentucky District also has in the gagehouse two Fisher-Porter central console units; one monitors headwater and tailwater gage heights, lockages, and gate openings for the 12 gates at 2-hr intervals, and the other monitors pressure differential on the manometers attached to each of the three turbines at 2-hr intervals.

Laboratory sample analyses

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky.

Data reduction procedures

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky.

Data reporting procedures

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky, except that discharge data have been published only in Reference 41. Figure A107 is an example of published sediment and biological data.

General information

The general information is the same as that for the Ohio River sediment sample collection station at Greenup Dam, Kentucky.

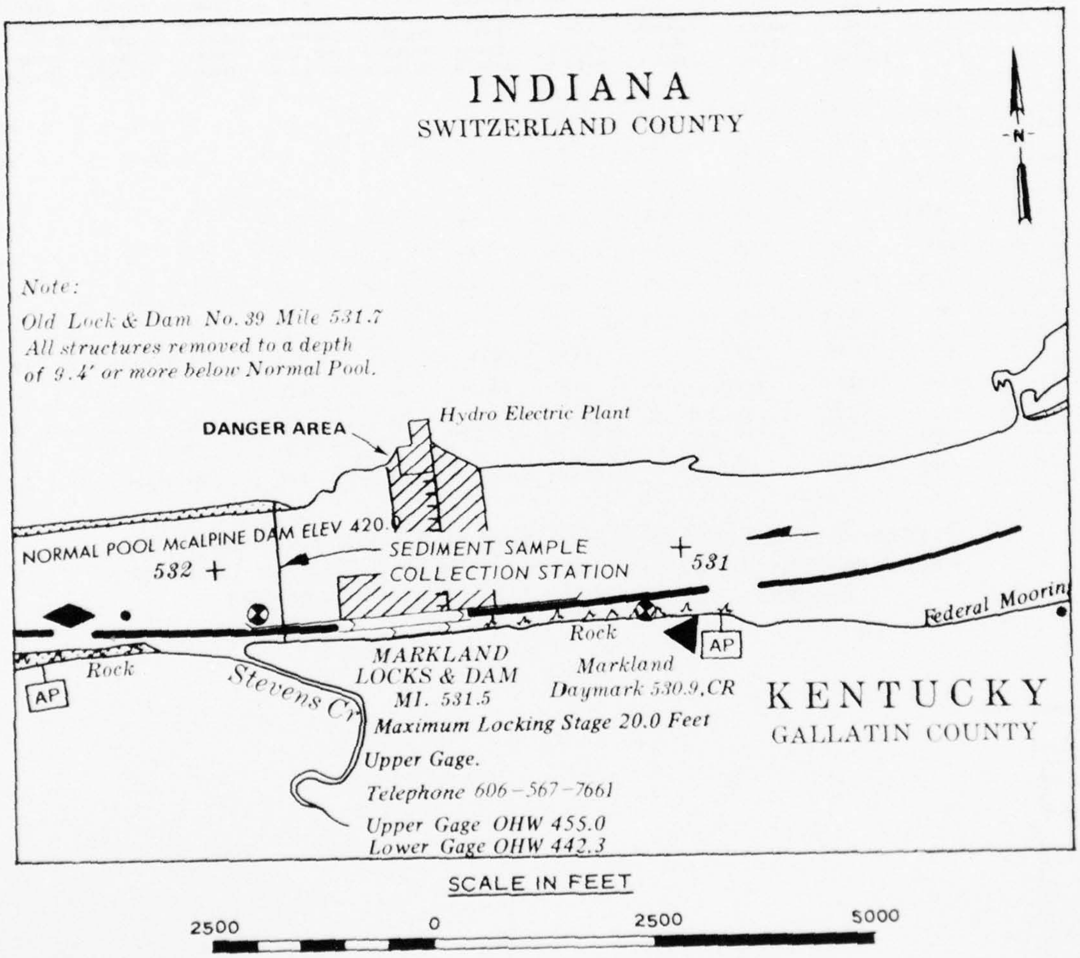

Figure A106. Site location for Markland Dam, Kentucky (Source: Chart No. 90, Ohio River Navigation Charts, Cairo, Illinois, to Foster, Kentucky, U. S. Army Engineer District, Louisville, Louisville, Kentucky, January 1975)

OHIO RIVER MAIN STEM

03277200 Ohio River at Markland Dam, Ky.

WATER QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DATE	TOTAL PHYTO-PLANK-TON (CELLS PER ML)	FECAL COLI-FORM (COL. PER 100 ML)	STREP-TOCOCCI (COL-ONIES PER 100 ML)	TOTAL ORGANIC CARBON (C) (MG/L)	PERI-PHYTON BIOMASS ASH WEIGHT G/SQ M	PERI-PHYTON BIOMASS TOTAL DRY WEIGHT G/SQ M	UNCOR-RECTED PERI-PHYTON CHLORO-PHYLL A MG/SQ M	UNCOR-RECTED PERI-PHYTON CHLORO-PHYLL B MG/SQ M	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)	SUS. SED. SIEVE DIAM. % FINER THAN .062 MM
OCT.											
30...	40000	--	--	2.9	--	--	--	--	18	1610	82
NOV.											
27...	1400	--	--	--	--	--	--	--	55	18400	88
DEC.											
20...	1700	--	--	--	--	--	--	--	--	--	--
JAN.											
24...	970	--	--	4.5	--	--	--	--	--	--	--
FEB.											
27...	2100	4200	3300	--	--	--	--	--	--	--	--
MAR.											
28...	1100	5100	580	--	--	--	--	--	--	--	--
APR.											
15...	890	68500	150	4.4	--	--	--	--	--	--	--
MAY											
13...	3200	61500	828	--	1.3	2.5	.1	.1	59	19800	100
JUNE											
10...	6000	61100	120	--	9.8	13	30	6.6	--	--	--
JULY											
22...	1300	110	40	3.4	44	48	47	5.6	--	--	--
30...	1800	--	--	--	--	--	--	--	--	--	--
SEP.									--	--	--
23...	1900	2900	92	--	29	41	57	5.2	24	4980	100

Figure A107. Example of sediment and biological data for Markland Dam, Kentucky (Source: Water Resources Data for Kentucky, 1975, USGS, Louisville, Kentucky)

Ohio River at Cannelton Dam, Kentucky

Station identification

OWDC No.: 83948

Agency station No.: 03303280

Latitude/longitude: 375358/864220

Agency reporting to OWDC: USGS

River mile: 718.8 (Mile 0 is at confluence of the Allegheny, Monogahela, and Ohio rivers; established by the CE in 1906.)

Site description

The sediment-sample collection station is upstream of Cannelton Locks and Dam (mile 720.7)(Figure A108). Discharges used to compute suspended-sediment loads are derived from velocity measurements made from the Lincoln Trail Highway Bridge downstream from the dam at mile 723.7. The banks in the vicinity of the station and immediately upstream are unprotected. However, there are three dikes perpendicular to the right (or Indiana) bank between the dam and the station. The economy of the region along the right bank in this reach is basically agricultural; that along the left (or Kentucky) is somewhat industrialized. Along the left bank at mile 719.6 is a 30-in. outfall discharging treated effluent from the Western Kraft Corporation directly into the Ohio River, and at mile 721.1 is another 24-in. outfall carrying similar effluent from Wescor Paper Board Corporation. Upstream from the station is very little industrial activity. The streambed in this reach of the Ohio River is sandy, and the approximate channel gradient is 0.3 ft/mile. Discharge has been measured at the Cannelton Dam site since October 1975; the gates of this dam have not yet been rated (although rating is almost finalized). Discharge values for the station are not yet available. Only two daily suspended-sediment load values have been published for the period of record (October 1974 to the present): 1,610 tons/day measured on 31 October 1974, and 25,700 tons/day measured on 25 November 1974.

Station chronological record

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky.

Sample and data collection procedures

Information is identical to that presented for the Ohio River sediment-sample collection at Greenup Dam, Kentucky, with the following exceptions:

a. Stream velocity measurements are made from the Lincoln Trails Highway Bridge (mile 723.7) using a Price current meter; the number of velocity verticals sampled at 20 and 80 percent of the total depth depends on the river stage. These measurements are taken at fixed distances from a reference point. A mean instantaneous discharge value for the stream is then obtained. There is no problem with lockages affecting velocity measurements.

b. Water-quality samples are taken by only the equal-transit-rate method (one bottle per trip) on at least three verticals located 22.5, 50, and 77.5 percent of the distance across the river. Samples taken during low flows are taken by the open-bottle (nozzleless) method, and no sediment analyses are run on these samples. During water year 1975, only two sediment analyses were run, and these represent the total of the published sampling data for the Cannelton Dam range. Alignment at this station is more difficult than at Greenup Dam, since crew members must rely on landmarks on the bank rather than on an overhead pipeline, and distances along the range are estimated.

c. At the Cannelton Dam lockmaster's office is a Stevens automatic digital recorder (central console), which monitors at 2-hr intervals the following parameters: headwater stage, tailwater stage, number of lockages, and gate openings of each of the 12 gates. These measurements began in October 1975, and they are the responsibility of the USGS Kentucky District. The gates at Cannelton Dam are not yet rated, but a rating table will be prepared within the next few months.

Laboratory sample analysis

Information is identical to that presented for the Ohio River sediment-sample collection station at Greenup Dam, Kentucky.

Data reduction procedures

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky.

Data reporting procedures

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky, except that daily discharge values have never been published in any form, because measurement of this parameter did not begin until October 1975. They will, however, be published beginning with the 1976 edition of Reference 41. Figure A109 is an example of water-quality suspended-sediment data from Reference 39.

General information

The USGS cautions using sediment data from this station with any degree of confidence since the two published values taken over the first year of record cannot be said to be representative of anything typical in this reach of the Ohio River. Because of the method of sampling and the sampling frequency, the USGS believes that the sediment measurements made at the Cannelton Dam are at best an approximation. They also feel that bed load constitutes a more significant portion of the sediment load of the Ohio River than does sediment load, but they have no data to substantiate this belief. Even though there is little sediment data available for this station, it is anticipated that the station will be operational over a long period of time as part of the National Stream Quality Accounting Network (NASQUAN) Program and should provide a source for needed data in future years.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, Room 572, Federal Building, 600 Federal Place, Louisville, Kentucky 40202.

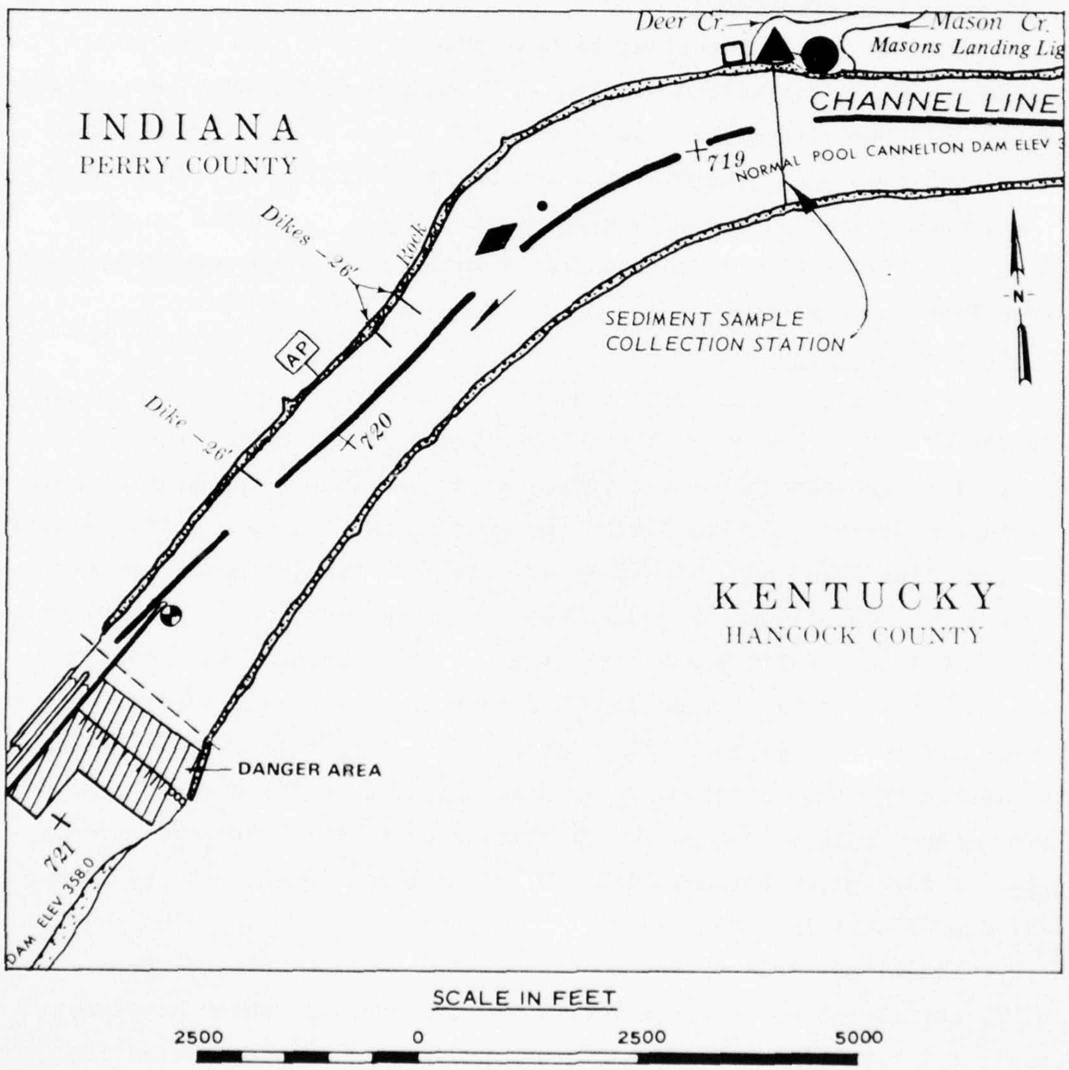

Figure A108. Site location for Cannelton Dam, Kentucky, sediment sample collection station (Source: Chart No. 53, Ohio River Navigation Charts, Cairo, Illinois, to Foster, Kentucky, U. S. Army Engineer District, Louisville, Louisville, Kentucky, January 1975)

OHIO RIVER MAIN STEM

03303280 Ohio River at Cannelton Dam, Ky.

WATER QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DATE	TOTAL PHYTO-PLANK-TON (CELLS PER ML)	FECAL COLI-FORM (COL. PER 100 ML)	STREP-TOCOCCI (COL-ONIES PER 100 ML)	TOTAL ORGANIC CARBON (C) (MG/L)	PERI-PHYTON BIOMASS ASH WEIGHT G/SQ M	PERI-PHYTON BIOMASS TOTAL DRY WEIGHT G/SQ M	UNCOR-RECTED PERI-PHYTON CHLORO-PHYLL A MG/SQ M	UNCOR-RECTED PERI-PHYTON CHLORO-PHYLL B MG/SQ M	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)	SUS. SED. SIEVE DIAM. % FINER THAN .062 MM
OCT. 31...	1200	--	--	4.9	--	--	--	--	17	1610	48
NOV. 25...	4300	--	--	--	3.1	--	.1	.2	63	25700	82
DEC. 23...	2800	--	--	--	--	--	--	--	--	--	--
JAN. 30...	1700	--	--	6.5	--	--	--	--	--	--	--
MAR. 03...	2100	81900	81200	--	--	--	--	--	--	--	--
26...	1200	2400	830	--	--	--	--	--	--	--	--
APR. 17...	1100	8400	812	6.5	--	--	--	--	--	--	--
MAY 14...	950	5100	819	--	--	--	--	--	--	--	--
JUNE 11...	2400	3800	69	--	--	--	--	--	--	--	--
JULY 23...	9400	822	82	4.4	11	18	73	17	--	--	--
AUG. 26...	1300	810	83	--	17	46	94	29	--	--	--

Figure A109. Example of water-quality and sediment data for Cannelton Dam, Kentucky (Source: Water Resources Data for Kentucky, 1975, USGS, Louisville, Kentucky)

Ohio River at Lock and Dam 53 near Grand Chain, Illinois

Station identification

OWDC No.: 56671

Agency station No.: 03612500

Latitude/longitude: 371211/890230

Agency reporting to OWDC: USGS

River mile: 962.2 (Mile 0 is at the confluence of the Allegheny, Monongahela, and Ohio rivers; established by the CE in 1906.)

Site description

The sediment sampling station is 0.4 mile upstream (mile 962.2) from Lock and Dam 53 (Figure A110). No instantaneous discharge measurements are taken at this station in conjunction with sediment sampling, because the instantaneous and daily discharge values determined at Metropolis, Illinois (mile 944.1) and its auxiliary gage on the right (or Illinois) bank of the river are nearly identical. Agriculture is practiced along both banks, but the left (or Kentucky) bank is generally more suited to this purpose. The city of Paducah and the confluence of the Tennessee and Ohio rivers are at mile 934.4. River traffic is heavy through Lock and Dam 53, which is less than 20 miles upstream from the confluence of the Ohio and Mississippi rivers. Both banks in this reach are unprotected, and there are no levees. The streambed material is composed of a mixture of sand and gravel, and the channel gradient is 0.5 ft/mile. The discharges at the Metropolis, Illinois, gage for the period of record (1928 to present) are: maximum - 1,780,000 cfs; mean - 262,200 cfs; and minimum - 15,000 cfs. Suspended sediment loads during the period of record (14 February 1973 to present) are: maximum - 519,000 tons/day; mean (of 31 measurements) - 104,993 tons/day; and minimum - 1,470 tons/day.

Station chronological record

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky, except that

the station was established in January 1973 and the first sediment analyses were made on samples collected on 14 February 1973.

Sample and data
collection procedures

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky, with the following exceptions:

a. No stream velocity measurements are made in conjunction with sediment sampling.

b. Sediment samples are taken by only the equal-transit-rate method (one bottle per trip) on at least three verticals at 22.5, 50, and 77.5 percent of the distance across the river. Samples collected during low flows are taken by the open-bottle (nozzleless) method, and no sediment analyses are run on these samples. Alignment at this station is more difficult than at Greenup Dam, since the field crew members must rely on landmarks on the banks rather than on an overhead pipeline, and distances are estimated.

c. Sediment loads are computed using discharges obtained from the Metropolis, Illinois, gage. The gaging station at Metropolis, Illinois (mile 944.1), on the Paducah and Illinois Railroad bridge, was equipped with a wire-weight gage mounted on the downstream side of the center span of this bridge from January 1928 to 29 May 1936. On 29 May 1936, a Stevens A-35 recorder driven by a manometer was installed in a metal shelter on the downstream side of the railroad bridge; and on 23 May 1969, a Fisher-Porter automatic digital recorder was also installed. The auxiliary gage used to compute discharge across this reach was first a staff gage located at Dam 53 (from January 1928 to 29 May 1936). On 29 May 1936, the auxiliary gage was moved to its present location (mile 962.2), the right bank of the sampling range, and a Stevens A-35 recorder was installed. On 23 May 1969, a Fisher-Porter automatic digital recorder was installed at the auxiliary gage. It has been necessary during the period of record to substitute days of missing record and to adjust both the base and auxiliary gage for data differences; this is accomplished by using data from the supplementary gages at Dams 52 (mile 938.9) and 53 (mile 926.6). Gaging at the Metropolis, Illinois, station is the responsibility of the USGS Kentucky District.

Laboratory sample analysis

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky.

Data reduction procedures

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky.

Data reporting procedures

Information is identical to that presented for the Ohio River sediment sample collection station at Greenup Dam, Kentucky, except that discharge data from the Metropolis, Illinois, gaging station prior to water year 1961 were published in Reference 12; from water year 1961 to the present, the data have been published in Reference 41. Figure A111 is an example of data from this station.

General information

The USGS cautions against using sediment data from this station with any degree of confidence, since the published values taken over the period of record may not be representative of the hydraulic regime in this reach of the Ohio River. Because of the method of sampling and the sampling frequency, the USGS believes that the sediment measurements made at the Dam 53 station are at best an approximation. The USGS also believes that bed load constitutes a more significant portion of the sediment load of the Ohio River than does sediment load, but it has no data to substantiate this belief. Even though there are little sediment data available for this station, it is anticipated that the station will be operated over a long time as part of the NASQUAN program and should provide a source for needed data in future years.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, Room 572, Federal Building, 600 Federal Place, Louisville, Kentucky 40202.

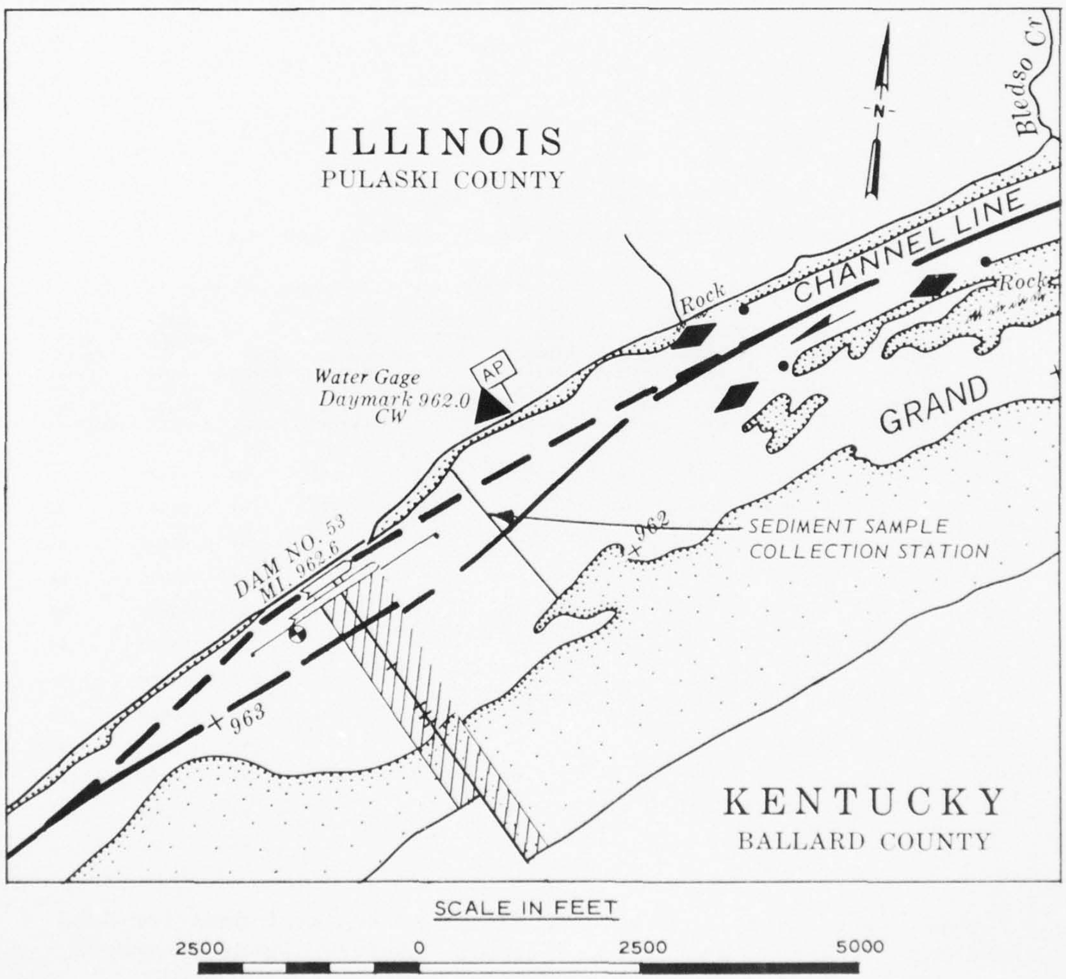

Figure A110. Site location for Lock and Dam 53, near Grand Chain, Illinois, sediment sample collection station (Source: Charts Nos. 4 and 5, Ohio River Navigation Charts, Cairo, Illinois, to Foster, Kentucky, U. S. Army Engineer District, Louisville, Louisville, Kentucky, January 1975)

AD-A039 571   ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS   F/G 8/8
INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISS--ETC(U)
MAR 77   M P KEOWN, E A DARDEAU, J G KENNEDY

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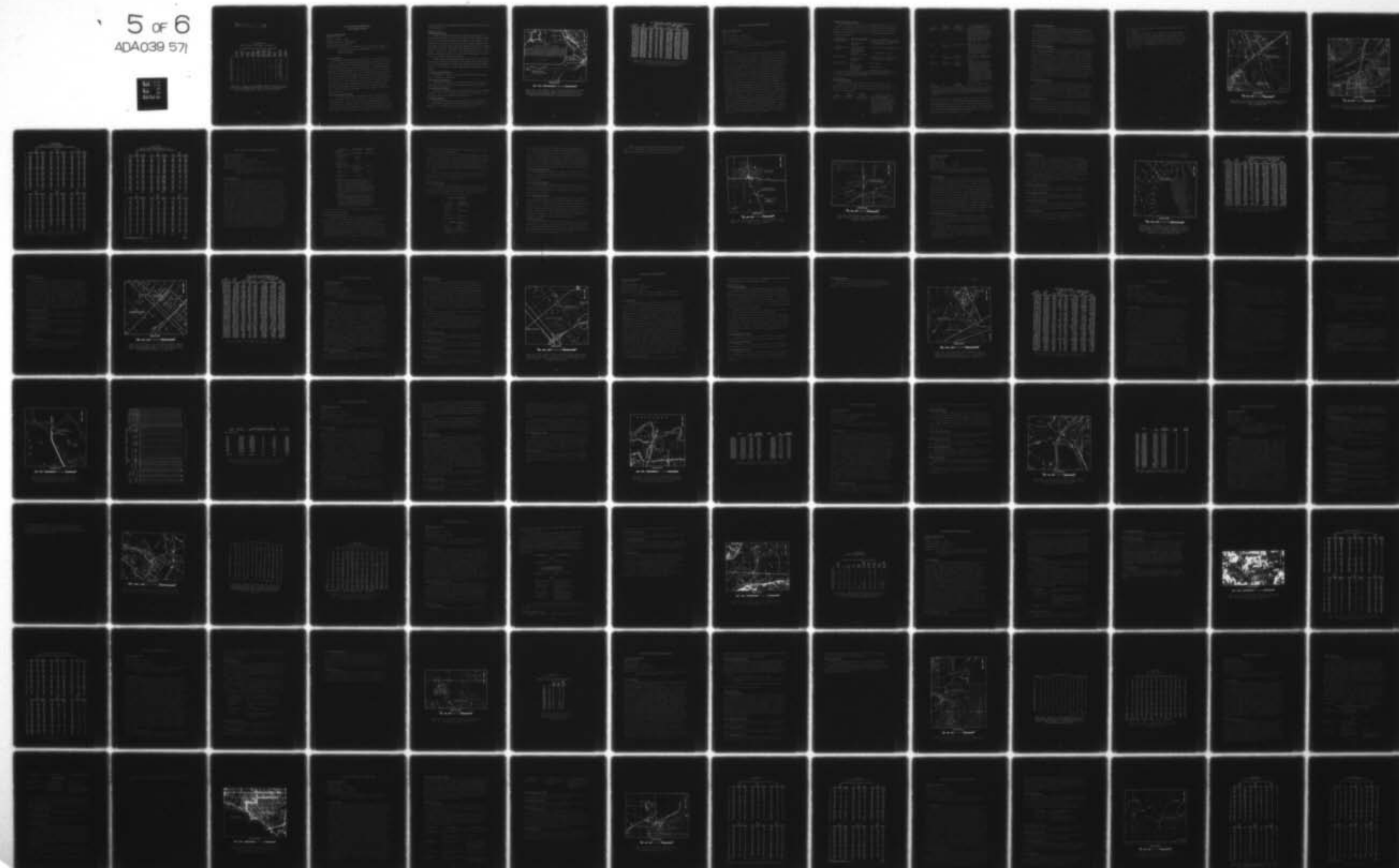

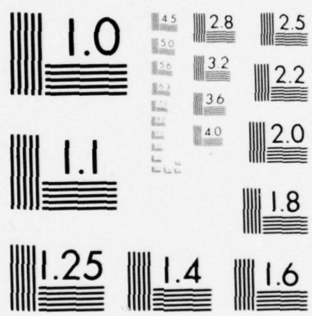

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

OHIO RIVER MAIN STEM

03612500 Ohio River at lock and dam 53, near Grand Chain, Ill.

WATER QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DATE	FECAL COLI-FORM (COL. PER 100 ML)	STREP-TOCOCCI (COL-ONIES PER 100 ML)	TOTAL ORGANIC CARBON (C) (MG/L)	PERI-PHYTON BIOMASS ASH WEIGHT G/SQ M	PERI-PHYTON BIOMASS TOTAL DRY WEIGHT G/SQ M	UNCOR-RECTED PERI-PHYTON CHLORO-PHYLL A MG/SQ M	UNCOR-RECTED PERI-PHYTON CHLORO-PHYLL B MG/SQ M	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)	SUS. SED. SIEVE DIAM. % FINER THAN .062 MM
OCT. 17...	--	--	4.7	3.1	11	1.3	.7	26	10900	55
NOV. 04...	--	--	--	4.6	7.7	.1	.1	40	14300	74
DEC. 04...	--	--	--	--	--	--	--	54	44500	85
JAN. 08...	--	--	4.0	--	--	--	--	136	210000	84
FEB. 18...	300	240	--	.60	2.5	3.5	4.4	99	170000	95
MAR. 26...	140	120	--	--	--	--	--	54	153000	98
APR. 08...	70	160	3.8	--	--	--	--	101	314000	78
MAY 13...	170	70	--	--	--	--	--	119	165000	90
JUNE 11...	550	140	--	--	--	--	--	147	105000	100
JULY 31...	150	328	--	--	--	--	--	28	9370	100
AUG. 20...	230	80	4.4	--	--	--	--	48	23200	100
SEP. 09...	8740	240	--	--	--	--	--	--	--	--

Figure A111. Example of water-quality and sediment data for Lock and Dam 53, near Grand Chain, Illinois (Source: Water Resources Data for Kentucky, 1975, USGS, Louisville, Kentucky)

Old River Outflow Channel near

Knox Landing, Louisiana

Station identification

OWDC No.: 54778

Agency station No.: 02600

Latitude/longitude: 310355/914115

Agency reporting to OWDC: CE

River mile: No mileage is established on Old River Outflow Channel, but the station is 5.5 miles downstream from the Old River Control Structure.

Site description

The sediment sample collection station is in a straight reach of the river 2.0 miles upstream from the confluence of the Old River Outflow Channel and the Red River. The gaging station is in the outflow channel at the Old River Control Structure (Figure A112). An artificial levee parallels the outflow channel 0.35 mile from the top of the right bank. The channel gradient through this reach is nearly flat and the bed material is composed mainly of medium-sized sands; it is not navigable for commercial traffic. The discharge is regulated by the control structure. The discharges of record (1961 to the present) are: maximum - 610,000 cfs; mean - 157,000 cfs; and minimum - 0 cfs (gates closed on control structure). The sediment loads of record are: 1,132,000 tons/day; mean - 165,000 tons/day; and minimum - 0 ton/day (gates closed on control structure).

Station chronological record

The sediment station was established in 1963 to monitor sediment flow from the Mississippi River through the outflow channel into the Atchafalaya Basin. The site chosen was an established discharge range. The CE New Orleans District (NOD) is responsible for collecting the samples and for reducing and publishing the data resulting from the laboratory analysis. Prior to June 1973, the samples were analyzed by the NOD

Laboratory and are now analyzed by the USGS Louisiana District Laboratory in Baton Rouge.

Sample and data collection procedures

Samples are taken twice monthly on three verticals with five point-integrated samples taken on each vertical. The samples are taken at 10, 25, 50, 75, and 90 percent of the depth of the vertical. The verticals are at 450, 750, and 1050 ft from a reference marker on the right bank. When the stage at Red River Landing exceeds 52 ft, samples are taken once a week. The samples are taken from a boat with a US P-61 sampler. (Prior to 15 April 1974, a US P-46 sampler was used.) Bed-material samples are taken with a drag bucket. Discharge is measured each day the sediment samples are taken.

River stage has been monitored during the period of record with a Stevens A-35B graphical recorder and a wire-weight gage, both attached to the Louisiana Highway 15 Bridge that crosses the Old River Control Structure. A staff gage is on the right bank 700 ft downstream from the bridge.

Laboratory sample analysis

Information is identical to that presented for the Atchafalaya River at Simmesport, Louisiana.

Data reduction procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reporting procedures

Sediment and discharge data are not published; however, an example of data for this station has been provided by the NOD (Figure A113). Daily gage heights are published in Reference 24.

General information

Additional information on this station can be obtained from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, Louisiana 70160.

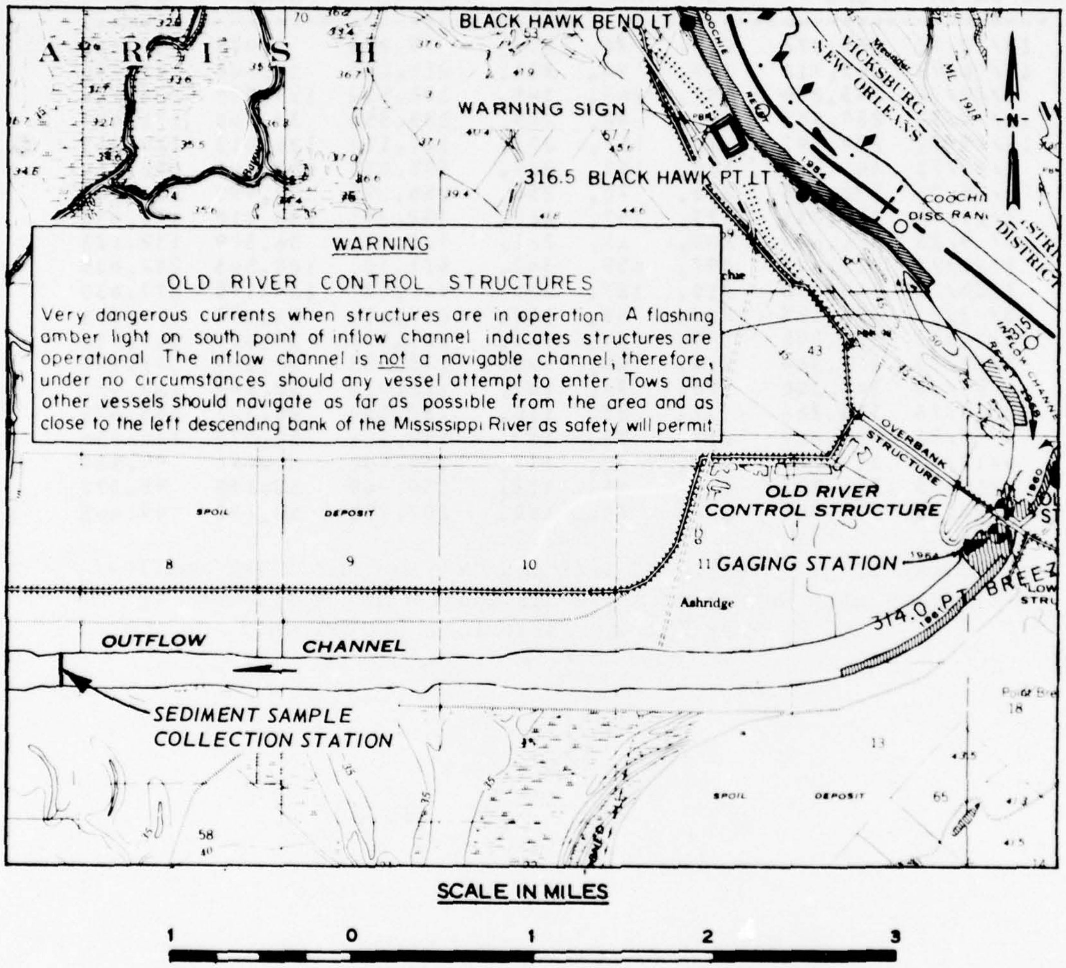

Figure A112. Site location for Old River Outflow Channel near Knox Landing, Louisiana, sediment sample collection station (Source: Flood Control and Navigation Maps of the Mississippi River, Map 41, Mississippi River Commission, Vicksburg, Mississippi, 1973)

OLD RIVER OUTFLOW CHANNEL NEAR KNOX LANDING, LA.
SUSPENDED SEDIMENT OBSERVATIONS

DATE	Q 1000	P.P.M.			1000 TONS/DAY		
MO DA YR	CFS	TOT	SAND	SILT	TOTAL	SAND	SILT
10/10/72	125,072	235.	28.	207.	79,293	9,477	69,815
11/ 6/72	265,711	304.	48.	256.	218,038	34,608	183,430
11/20/72	243,256	592.	243.	349.	388,532	159,598	228,934
12/ 4/72	259,581	291.	46.	245.	203,558	32,060	171,499
12/19/72	299,197	430.	157.	273.	347,176	126,913	220,263
1/ 8/73	341,262	386.	177.	209.	355,035	162,701	192,334
2/ 5/73	292,178	326.	70.	256.	256,697	54,995	201,701
2/21/73	326,735	377.	157.	220.	332,257	138,418	193,838
3/ 5/73	221,699	282.	61.	221.	168,471	36,349	132,123
3/21/73	306,648	497.	155.	342.	411,308	128,503	282,805
3/28/73	363,796	410.	127.	283.	401,827	124,198	277,630
5/ 2/73	395,185	200.	48.	152.	213,134	51,152	161,981
5/12/73	393,895	197.	37.	160.	209,570	39,620	169,950
5/19/73	375,384	174.	28.	146.	175,933	28,141	147,792
5/23/73	360,358	178.	34.	144.	172,875	32,942	139,932
5/30/73	356,260	137.	27.	110.	132,000	26,323	105,677
6/ 5/73	324,609	217.	57.	160.	190,126	50,070	140,056
6/12/73	310,129	166.	47.	119.	138,408	38,888	99,520
6/19/73	315,793	158.	46.	112.	134,209	38,832	95,377
6/26/73	307,921	250.	70.	180.	207,255	57,792	149,463

Figure A113. Example of sediment data for Old River Outflow Channel near Knox Landing, Louisiana (printout provided by U. S. Army Engineer District, New Orleans)

Platte River at Louisville, Nebraska

Station identification

OWDC No.: 54751

Agency station No.: 06805500

Latitude/longitude: 410050/960929

Agency reporting to OWDE: CE

River mile: 16.4 (Mile 0 is at the confluence of the Platte and Missouri rivers; established by the USGS in 1969.)

Site description

Prior to June 1952, the sediment station was on the U. S. Highway 6 Bridge at Ashland, Nebraska, at mile 27.8. Since June 1952 the station has been on the Nebraska State Highway 50 Bridge at Louisville, Nebraska, at mile 16.4. The Ashland station was on a relatively straight reach of the Platte River (Figure A114), as is the Louisville station (Figure A115). There is no bank protection (except at the bridgeheads), and frequent bank sloughing occurs. The stream is not navigable for commercial traffic at the location of either station. The streambed consists of sand, and the gradient through this reach is approximately 4 to 5 ft/mile. The land upstream from these stations is used almost exclusively for agriculture. Annual soil loss due to erosion in the vicinity of the stations is 1,000-3,000 tons/square mile decreasing to 100-400 tons/square mile further upstream. The natural flow of the stream is greatly affected by upstream impoundments, power developments, diversions, and groundwater withdrawal and return flow from irrigation. The discharges of record (from 1928 to the present)are: maximum - 124,000 cfs; mean - 5,790 cfs; and minimum - 240 cfs. The gaging station was at Ashland (mile 27.8) from 1928 through 1953; at Louisville (mile 16.4) from 1953-1961; at South Bend, Nebraska (mile 23.4), from 1961-1973; and is now back at Louisville. The sediment and discharge data taken at the various stations are considered to be from the same location. Sediment loads of record (from 1939 to the present) are: maximum - 4,656,000 tons/day; mean - 47,100 tons/day; and the minimum - 58 tons/day.

Station chronological record

The station was established by the CE Omaha District (OD) in 1939 to monitor the sediment contribution of the Platte River to the Missouri River. The USGS Nebraska District took over operation of the station in October 1971 under contract to the OD. Operations are detailed in the following tabulation:

Activity	Responsible Agency	Dates
Sample collection	OD	18 April 1939 - 30 September 1971
	USGS Nebraska District	1 October 1939 - present
Laboratory sample analysis	CE Missouri River Division (MRD) Soils Laboratory	18 April 1939 - 30 September 1971
	USGS Soils Laboratory, Lincoln	1 October 1971 - present
Data reduction	OD	18 April 1939 - 30 September 1971
	USGS Nebraska District	1 October 1971 - present
Data publication	OD	1939 - 1969
	Kansas City District (KCD)	1970 - present
	USGS Nebraska District*	1 October 1971 - present

* Data are also available from WATSTORE, an automated information retrieval program operated by the USGS.

Sample and data collection procedures

Samples were collected weekly by the OD from 18 April 1939 to 30 September 1971, with additional samples taken during high flows. The USGS Nebraska District began collecting samples on 1 October 1971. Details are tabulated below:

Dates	Type of Sample	Equipment Used	Description or Purposes of Procedure
1939-54	Grab	Milk bottles	To attempt to correlate surface sediment concentration with the concentrations obtained from point samples. Point samples were taken with milk bottles during heavy debris and ice flow to avoid risk of loosing a sampler.

Dates	Type of Sample	Equipment Used	Description or Purposes of Procedure
1939-54	Point	Omaha sampler	Samples were taken on three verticals* equally distributed across the stream when the discharge was less than 1000 cfs. Five verticals were taken when the discharge was greater than 1000 cfs.
1954-55	Depth-integrated	Omaha sampler	Samples were taken on three verticals when the discharge was less than 1000 cfs. Five verticals were taken when the discharge was greater than 1000 cfs.
1955-71	Depth-integrated	US D-49 US DH-48	Same as above. Handheld sampler was used during low flows.
1971 - present	Depth-integrated	US D-49 US DH-48 US DH-59	A single vertical is taken daily by a paid observer. USGS personnel take 10-20 verticals every two weeks (using ETR method, see Reference 1a) to determine a coefficient to be applied to the concentration determined from the observer's single vertical. The handheld samplers are used during low flows.
1971 - present	Bed	US BM-54 US BMH-54	Samples are taken monthly.

* The points on the verticals were determined by Luby tables; the horizontal spacings between verticals were determined by the equal-discharge-rate (EDR) method. All procedures are described in Reference 1a.

Water stage was measured at Ashland (1928-1953) with a still well and a staff gage and later a Stevens A-35 continuous recorder; at Louisville (1953-1961 and 1973 to the present) with a bubble gage (manometer) driving a Fisher-Porter automatic digital recorder; and at South Bend (1961-1973) with a bubble gage (manometer) driving a Fisher-Porter automatic digital recorder and a Stevens A-35 for backup.

Laboratory sample analysis

Prior to 1 October 1971, the MRD Soils Laboratory analyzed the samples for suspended-sediment concentration and bed-material particle-size distribution, using the methods outlined in References 6-8. After the USGS Nebraska District took over the station, the USGS Soils Laboratory in Lincoln analyzed the samples for suspended-sediment concentration and bed-material particle-size distribution, following the methods described in Reference 1b.

Data reduction procedures

Prior to 1 October 1971, the OD computed sediment load (tons/day) from the suspended-sediment concentration reported from the laboratory analyses and the discharge. The data reduction procedure was automated in 1965 with the KCD load program (Reference 9). After 1 October 1971, the USGS Nebraska District was responsible for data reduction. The concentration data obtained at the station were plotted on a gage-height chart, and a smoothed curve was drawn through points of sediment concentration. Daily sediment loads were computed by multiplying the product of the mean daily discharge and the mean concentration (from the smoothed curve) by 0.0027 to convert to tons per day. These sediment computations were made with the Water Resources Division (WRD) sediment computer program W-4252.

Data reporting procedures

Suspended-sediment load and discharge have been reported by the OD on a daily basis since 1939 (Reference 11). Suspended-sediment load and discharge have been reported by the USGS Nebraska District on a daily basis since 1971 (References 23 and 13). Figure A116 shows a sample of data reported for this station. Data are also entered in WATSTORE, an automated information storage and retrieval program operated by the USGS.

General information

Sediment records for this station are considered to be good, with the possible exception of those samples taken during winter periods and those taken with the Omaha sampler. The nozzle on this sampler is in the shape of a right angle, and the intake is positioned perpendicular to the streamflow during the sampling procedure. There is some question

as to whether the larger sediment could follow the stream lines at the nozzle intake.

Additional information on this station can be obtained from: U. S. Army Engineer District, Omaha, Hydrologic Engineering Branch, Water Quality and Sediment Section, Federal Building, Omaha, Nebraska 68102; or from: U. S. Department of the Interior, Geologic Survey, Nebraska District, 100 Centennial Mall North, Room 406, Lincoln, Nebraska 68598.

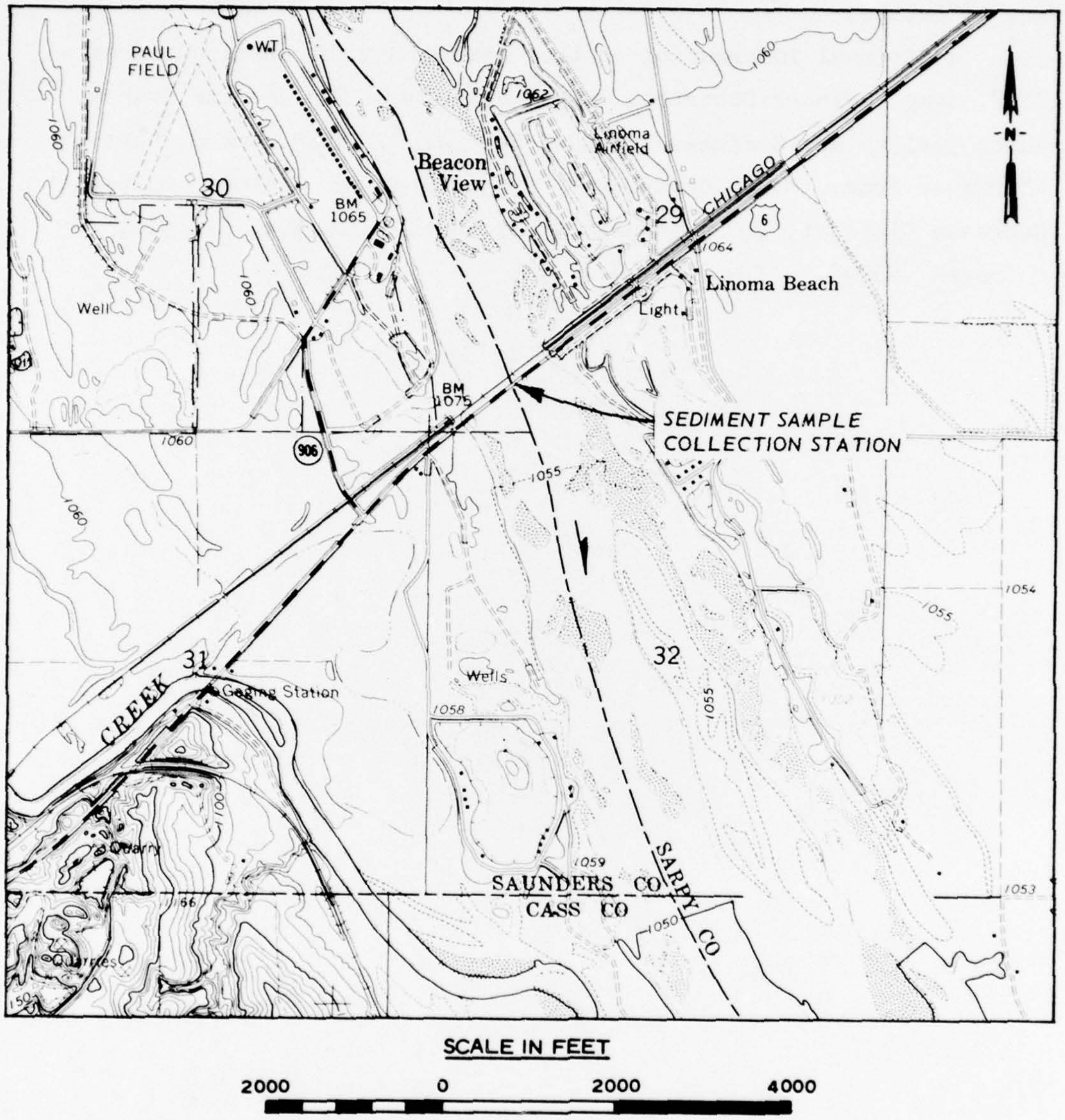

Figure A114. Site location for Ashland, Nebraska, sediment sample collection station (Source: USGS Quadrangle Map for Ashland East, Nebraska, 1968)

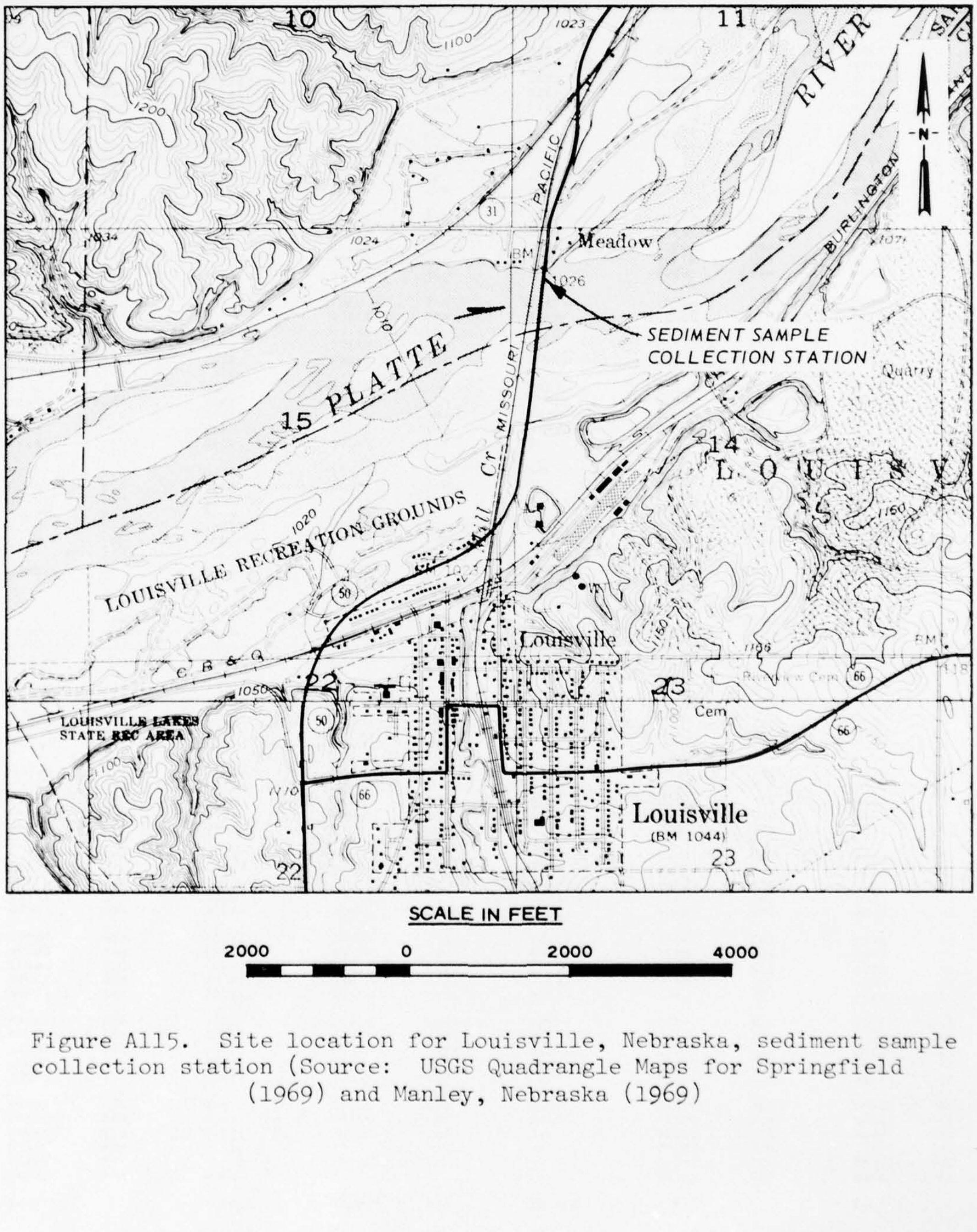

Figure A115. Site location for Louisville, Nebraska, sediment sample collection station (Source: USGS Quadrangle Maps for Springfield (1969) and Manley, Nebraska (1969)

PLATTE RIVER BASIN

06805500 PLATTE RIVER AT LOUISVILLE, NEBR

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	19300	1010	52600	8930	490	11800	11300	420	12800
2	16000	930	40200	9470	510	13000	11000	400	11900
3	14200	780	29900	8740	480	11300	11000	430	12800
4	13400	640	23200	8810	485	11500	11600	500	15700
5	12200	480	15800	8070	450	9800	9600	500	13000
6	11400	375	11500	8310	494	11100	8600	502	11700
7	10800	570	16600	8240	460	10200	7600	550	11300
8	10000	530	14300	7950	445	9550	7200	606	11800
9	9700	520	13600	8100	455	9950	7200	520	10100
10	20100	1040	56400	7930	445	9530	7200	521	10100
11	39000	2450	258000	8220	455	10100	7400	550	11000
12	40100	2550	276000	8370	460	10400	7200	587	11400
13	27300	1480	109000	8290	460	10300	6800	530	9730
14	19400	980	51300	9750	520	13700	6400	495	8550
15	16800	840	38100	9030	495	12100	5800	450	7050
16	14400	720	28000	7830	440	9300	6200	480	8040
17	13100	670	23700	8980	490	11900	6200	480	8040
18	12100	620	20300	9140	490	12100	5400	420	6120
19	12200	630	20800	8940	485	11700	4100	330	3650
20	11200	580	17500	10100	532	14500	3000	265	2150
21	11000	580	17200	4600	740	29200	4500	355	4310
22	10600	560	16000	15800	800	34100	5800	450	7050
23	10400	362	10200	13400	680	24600	5600	430	6500
24	10400	362	10200	11900	620	19900	6400	495	8550
25	10200	275	7570	13000	660	23200	6200	480	8040
26	10200	275	7570	11900	577	18500	6000	460	7450
27	9780	305	8050	11900	550	17700	6400	466	8050
28	9680	315	8230	11400	500	15400	7000	550	10400
29	9560	324	8360	11400	460	14200	6600	508	9050
30	9620	332	8620	11400	436	13500	5800	450	7050
31	9310	339	8520	--	--	--	5000	390	5260
TOTAL	453450	--	1227320	299900	--	434130	216100	--	278640

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	4000	320	3460	10800	407	11900	11500	770	23900
2	4500	350	4250	11000	410	12200	11500	852	26500
3	4400	340	4040	11000	410	12200	11100	750	22500
4	4200	330	3740	11600	426	13300	10100	509	13900
5	4500	350	4250	12000	460	14900	10100	600	16400
6	4600	360	4470	11000	361	10700	10800	900	26200
7	4300	300	3480	10400	370	10400	10700	890	25700
8	4600	320	3970	9600	380	9850	10000	845	22800
9	4400	280	3330	9200	390	9690	9830	800	21200
10	4700	300	3810	8910	410	9860	9460	713	18200
11	4400	230	2730	8490	512	11700	9790	600	15900
12	4300	180	2090	9350	480	12100	10200	370	10200
13	4900	180	2380	10900	600	17700	10100	450	12300
14	5800	180	2820	12600	983	33400	10200	545	15000
15	7400	180	3600	13200	800	28500	10300	474	13200
16	9400	183	4640	13700	720	26600	11200	492	14900
17	9200	200	4970	14900	1000	40200	11200	500	15100
18	9000	233	5660	18200	1450	71300	11400	530	16300
19	8800	220	5230	16900	1350	61600	11800	550	17500
20	9400	195	4950	18700	1250	63100	11300	512	15600
21	9200	230	5710	17200	1300	60400	11200	550	16600
22	9200	270	6710	13700	1350	49900	11200	687	20800
23	9800	800	21200	11800	1150	36600	11300	680	20700
24	10600	1030	29500	12200	1200	39500	11700	641	20200
25	11000	1300	38600	9320	900	22600	11000	580	17200
26	10800	1280	37300	9380	872	22100	12600	765	26000
27	10200	950	26200	10500	780	22100	11200	640	19400
28	10000	872	23500	11700	687	21700	10800	510	14900
29	11000	650	19300	--	--	--	11000	630	18700
30	12000	459	14900	--	--	--	11100	701	21000
31	10600	390	11200	--	--	--	9350	500	12600
TOTAL	231200	--	311990	338250	--	756100	335030	--	571400

Figure A116. Example of data for Louisville, Nebraska (Source: Water Resources Data for Nebraska, Part II, USGS, Lincoln, Nebraska)
(sheet 1 of 2)

PLATTE RIVER BASIN

06805500 PLATTE RIVER AT LOUISVILLE, NEBR.--CONTINUED

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCENTRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCENTRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCENTRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)
1	11200	629	19000	9730	450	11800	8350	1330	30000
2	11100	500	15000	9950	377	10100	6200	1220	20400
3	11500	402	12500	8890	370	8880	5650	1080	16500
4	13500	680	24800	8250	377	8400	5310	850	12200
5	13000	622	21800	7590	340	6970	4730	511	6530
6	13600	550	20200	6970	312	5870	4970	600	8050
7	13100	436	15400	6950	310	5820	5120	710	9820
8	13000	400	14000	7090	306	5860	7440	1350	27100
9	12100	350	11400	6310	660	11200	6960	1920	36100
10	12300	383	12700	6090	1090	17900	6330	1940	33200
11	12400	400	13400	8140	1640	36000	8010	1940	42000
12	12800	450	15600	12000	2280	73900	13000	2450	86000
13	13100	460	16300	10100	1380	37600	9940	3100	83200
14	14100	493	18800	8380	680	15400	9250	2190	54700
15	13700	500	18500	7940	500	10700	7770	1010	21200
16	14100	555	21100	6450	386	6720	7680	660	13700
17	13400	480	17400	6740	900	16400	7460	633	12700
18	12400	377	12600	8560	3860	96800	6090	590	9700
19	11900	360	11600	24800	11600	789000	5760	574	8930
20	11900	348	11200	17300	8750	409000	5240	520	7360
21	11100	430	12900	11500	7080	220000	4380	446	5270
22	11200	478	14500	21800	10600	644000	4520	460	5610
23	10100	440	12000	12700	4850	179000	3980	312	3350
24	9660	415	10800	8350	1850	41700	3430	300	2780
25	9600	379	9820	7080	1000	19100	3530	329	3140
26	9400	364	9240	7250	850	16600	3280	300	2660
27	8880	360	8630	9990	1400	37800	2830	278	2120
28	11100	369	11100	8190	1870	41400	2760	300	2240
29	12100	500	16300	8980	1650	40000	2440	321	2110
30	10000	609	16400	8240	1570	34900	2400	310	2010
31	--	--	--	8600	1450	33700	--	--	--
TOTAL	357340	--	444990	306910	--	2892520	174810	--	570680

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCENTRATION (MG/L)	JULY SEDIMENT DISCHARGE (TONS/DAY)	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCENTRATION (MG/L)	AUGUST SEDIMENT DISCHARGE (TONS/DAY)	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCENTRATION (MG/L)	SEPTEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	2280	296	1820	413	152	169	1590	182	781
2	2090	240	1350	537	185	268	1760	270	1280
3	1910	221	1140	573	200	309	1610	234	1020
4	1930	260	1350	573	200	309	1500	220	891
5	1670	273	1230	691	210	392	1550	229	958
6	1540	260	1080	923	240	598	1580	290	1240
7	1530	250	1030	935	260	656	1560	291	1230
8	1300	200	702	845	210	479	1690	280	1280
9	1250	187	631	1150	220	683	1800	249	1210
10	1270	190	652	1650	240	1070	1570	200	848
11	1190	153	492	1670	240	1080	1620	210	919
12	1120	145	438	1720	250	1160	1860	220	1100
13	1040	140	393	1550	300	1260	1950	222	1170
14	984	140	372	1450	322	1260	1620	210	919
15	895	139	336	1700	314	1440	1890	247	1260
16	801	120	260	2330	369	2320	1890	250	1280
17	699	110	208	2750	600	4460	1910	300	1550
18	650	110	193	2370	551	3530	2050	310	1720
19	613	110	182	2030	350	1920	1990	250	1340
20	601	110	178	2010	331	1800	2030	281	1540
21	547	110	162	1970	330	1760	1880	240	1220
22	539	110	160	2350	340	2160	1740	225	1060
23	546	110	162	2150	280	1630	1980	260	1390
24	498	110	148	2330	313	1970	1730	156	729
25	445	110	132	1680	240	1090	1720	200	929
26	400	110	119	1650	238	1060	1840	311	1550
27	391	110	116	1790	250	1210	1990	250	1340
28	425	110	126	1740	232	1090	2030	205	1120
29	419	110	124	1560	220	927	1950	250	1320
30	385	110	114	1490	203	817	1970	277	1470
31	373	110	111	1490	190	764	--	--	--
TOTAL	30331	--	15511	48070	--	39641	53850	--	35664

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 2839241
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 7578586

Figure A116 (sheet 2 of 2)

Platte River at North Bend and Schuyler, Nebraska

Station identification

OWDC No.: 73455; 56353

Agency station Nos.: 06796000; 06794700

Latitude/longitude: 412710/964550; 412450/970335

Agency reporting to OWDC: USGS

River mile: North Bend, 73.0; Schuyler, 89.5. (Mile 0 is at the confluence of the Platte and Missouri rivers; established by the USGS in 1969.)

Site description

The USGS operates a sediment sample collection station on the Platte River at North Bend, Nebraska, and has operated a station at Schuyler, Nebraska. Because of the close proximity of these two stations and the similarity of their banks, gradients, and channel conditions, and because no tributary streams enter the relatively straight reach of the Platte River between these two stations, their records are regarded by the USGS as representative of the same reach of the Platte River. The North Bend sediment and gaging stations are on the Nebraska State Highway 79 Bridge, 1.0 mile south of North Bend (Figure A117), and the now-defunct Schuyler sediment and gaging stations were on the Nebraska State Highway 15 Bridge, 2.6 miles south of Schuyler (Figure A118). The Platte River is not navigable for commercial traffic in this reach, and its banks are unprotected, gently sloping, and covered with scattered trees and nonwoody vegetation. A canal enters the river 10 miles upstream from Schuyler. There is agricultural activity along both banks. The streambed material is sand, and the approximate channel gradient is 4.8 ft/mile. The tabulation below lists the discharges and sediment loads measured during the periods of record of the two stations:

Station	North Bend	Schuyler
Discharge:		
Period of record (water years)	1949-present	1966-1968*
Maximum, cfs	112,000	
Mean, cfs	4,081	
Minimum, cfs	36	
Sediment load:		
Period of record (water years)	1966-1967, 1970-1971, 1973-present	1966-1968
Maximum, tons/day	1,460,000	185,000
Minimum, tons/day	27,200**	380

* Only a few discharge measurements were made at Schuyler during peak flows in connection with sediment sampling. The USGS believes that these few measurements are not representative of daily flows and that the extremes of flow measured at the North Bend gaging station should be used instead.

** Minimum sediment loads measured at North Bend are hardly representative, since these measurements were made during peak flows. It is possible that lower minimum loads were recorded during the winter sampling of water year 1975. These data, however, have not yet been processed.

The estimated annual soil loss in the vicinity of both sediment stations is 100-400 tons/square mile.

Station chronological record

North Bend, Nebraska, an active stream-gaging station since 1949, was established as a sediment sample collection station on 14 August 1966 to monitor sediment loads on this reach of the Platte River. Intermittent suspended-sediment and bed-material samples were collected during the period of record as shown on the tabulation under "Site description" through water year 1974; beginning in water year 1975, these samples were taken on a monthly basis. In October 1972, the USGS began collecting chemical data on a monthly basis and water temperatures on a

daily basis. This station became part of the National Stream Quality Accounting Network in October 1973.

A sediment sample collection station was established at Schuyler, Nebraska, in 1966 to monitor sediment loads in the Linwood-Cedar Bluffs reach of the Platte River, the site of a proposed (but never constructed) Bureau of Reclamation dam. Suspended-sediment and bed-material data were collected intermittently during 1966 and monthly during 1967 and 1968. Water temperature and discharges were measured when these samples were collected.

Sample collection, sample laboratory analysis, data reduction, and data publication for both the North Bend and Schuyler stations are the responsibility of the USGS Nebraska District.

Sample and data
collection procedures

Depth-integrated suspended-sediment samples (taken by the equal-transit-rate (ETR) method) and bed-material samples were collected with US D-49 and US BM-54 samplers, respectively, at the North Bend and Schuyler stations according to the following schedule:

North Bend, Nebraska

Year	Sampling Frequency
1966-1967	Intermittently
1968-1969	None
1970-1971	Intermittently
1972	None
1973-1974	Intermittently
1975-present	Monthly

Schuyler, Nebraska*

Year	Sampling Frequency
1966	Intermittently
1967-1968	Monthly

* Station discontinued in 1968.

These samplers and the ERT method are discussed in Reference 1a.

River stage has been measured daily at North Bend since 1949. Prior to 12 September 1951, there was a wire-weight gage at the site. Since 12 September 1951, there has been a Stevens A-35 recorder, and since 2 June 1964, there has also been a Fisher-Porter automatic digital recorder. The discharge is computed using the rating curve developed for this reach of the river. At Schuyler, the discharge was measured only intermittently at peak flows in conjunction with sediment sampling.

Laboratory sample analysis

Suspended-sediment samples are analyzed for concentrations, and bed-material samples are analyzed for particle-size distribution by the USGS Soils Laboratory, Lincoln, Nebraska. The methods used are discussed in Reference 1b.

Data reduction procedures

Suspended-sediment concentration and discharge values are used to compute suspended-sediment loads. Data reduction is the responsibility of the USGS Nebraska District. The procedures used to reduce the data are discussed in Reference 1c.

Data reporting procedures

All available values of bed-material particle-size distribution, suspended-sediment concentration, suspended-sediment load, and discharge, as well as temperature and results of chemical analyses, appear in Reference 23. The data are also entered into the the USGS Water Resources Division Water-Quality Files and the Environmental Protection Agency's STORET System. Daily discharge values from North Bend are published in Reference 13 and are entered in the USGS WATSTORE files. No examples of published sediment data are available.

General information

Since the stations at North Bend and Schuyler were operated only intermittently or monthly for their periods of record, the USGS regards the suspended-sediment and bed-material data as somewhat questionable. The daily discharge records for North Bend are regarded as good, except for those taken during winter periods, which are poor.

Additional information on the North Bend station can be obtained from: U. S. Department of the Interior, Geological Survey, Nebraska District, 110 Centennial Mall North, Lincoln, Nebraska 68508.

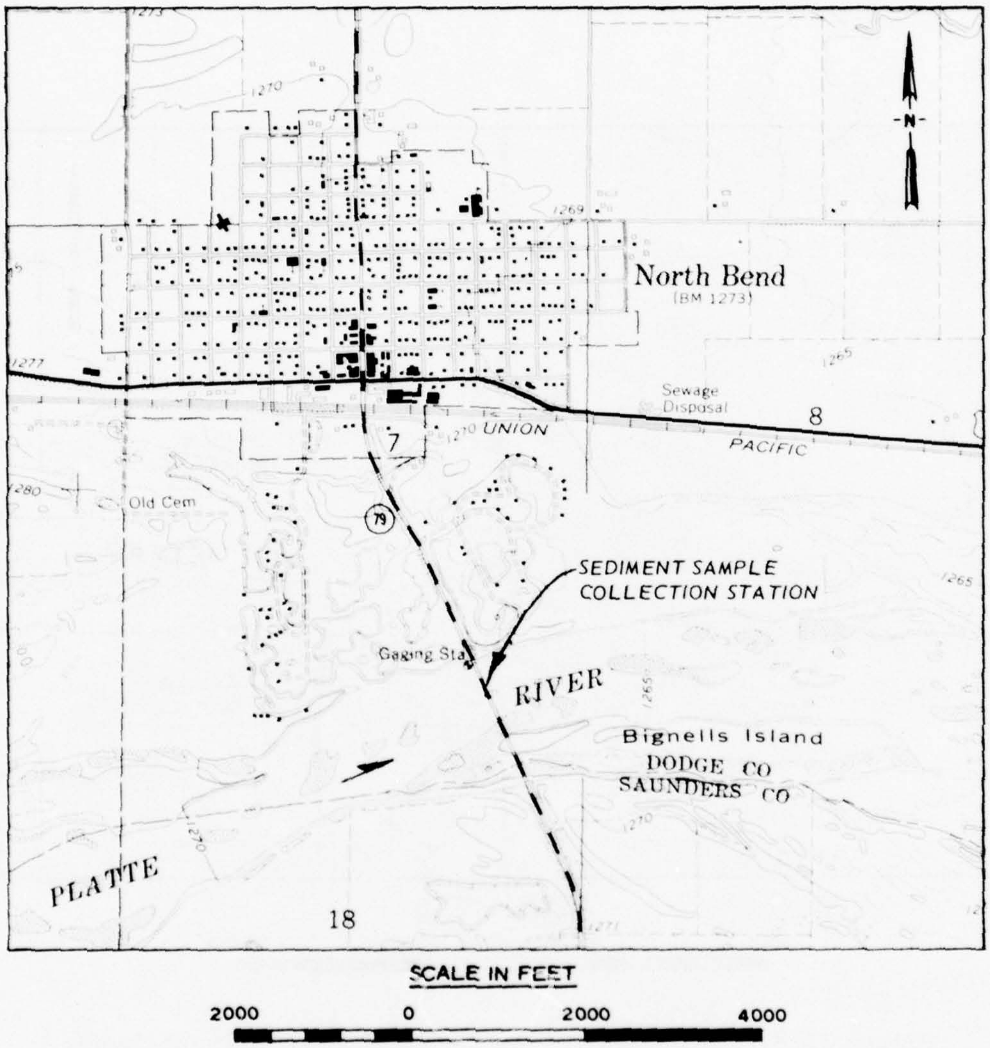

Figure A117. Site location for North Bend, Nebraska, sediment sample collection station (Source: USGS Quadrangle for North Bend, Nebraska, 1968)

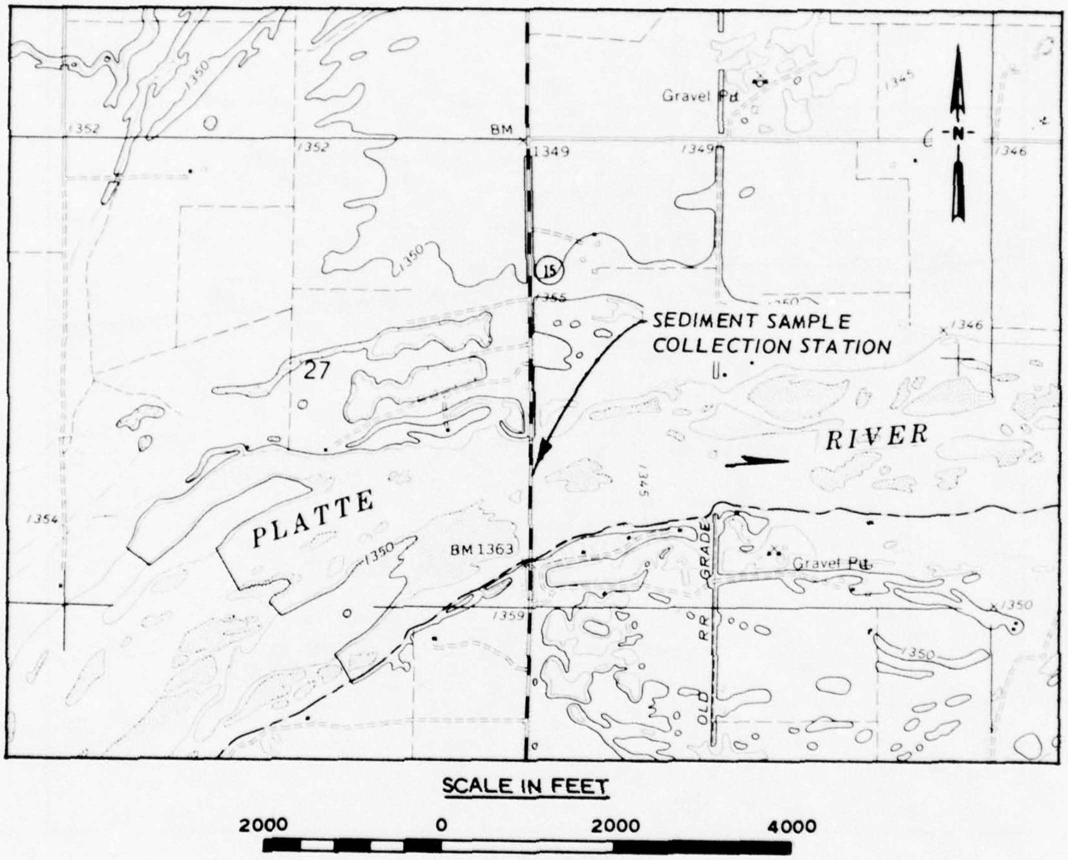

Figure A118. Site location for Schuyler, Nebraska, sediment sample collection station (Source: USGS Quadrangle for Schuyler, Nebraska, 1968)

Red River Above Old River Outflow Channel, Louisiana

Station identification

OWDC No.: 54884

Agency station No.: 04800

Latitude/longitude: 310408/914245

Agency reporting to OWDE: CE

River mile: 13.1 (Mile 0 is at the confluence of the Lower Old and Mississippi rivers; established by the CE in 1967.)

Site description

The sediment sample collection station is at a discharge range 2.6 miles above the confluence of the Red River and Old River Outflow Channel and 6.3 miles above the confluence of the Lower Old, Red, and Atchafalaya rivers (Figure A119). The river stage is read at Barbre Landing at mile 6.1 (Lower Old River). The sediment sampling station is in a bend, and there is neither protection on either bank nor any cultural activity in the vicinity of the station that would affect sediment loads. The bed material is composed mainly of very fine sands, and the gradient through this reach is 0.35 ft/mile. The Red River is navigable for commercial traffic through this reach. The maximum discharge of record (1965 to the present) is 187,000 cfs. The maximum sediment load of record (1965 to the present) is 1,552,000 tons/day. No mean or minimum discharge or sediment load data are available for this station.

Station chronological record

The station was established in 1963 to monitor the sediment contribution of the Red River to the Atchafalaya River. The site was established at this particular location because there was a discharge range already there.

The CE New Orleans District (NOD) is responsible for collecting the samples and reducing and publishing the data resulting from the laboratory analysis. Prior to June 1973, the samples were analyzed by the NOD Laboratory and are now analyzed by the USGS Louisiana District Laboratory in Baton Rouge.

Sample and data
<u>collection procedures</u>

Samples were taken twice monthly on three verticals with five point-integrated samples on each vertical prior to 1976. The verticals were spaced 200 ft apart. Two verticals are now taken at 375 and 675 ft from a reference marker on the right bank. The samples are taken at 10, 25, 50, 75, and 90 percent of the depth of the vertical. During high flows, samples are collected weekly. The samples are taken from a boat with a US P-61 sampler. (Prior to 15 April 1974, a US P-46 sampler was used.) Bed-material samples are taken with a drag bucket.

Discharge and temperature observations are taken each day that sediment samples are taken.

<u>Laboratory sample analysis</u>

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

<u>Data reduction procedures</u>

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

<u>Data reporting procedures</u>

None of the discharge or sediment data have been published; however, a printout for this station provided by the NOD is shown in Figure A120. Daily gage heights are published in Reference 24.

<u>General information</u>

Additional information on this station can be obtained from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, Louisiana 70160.

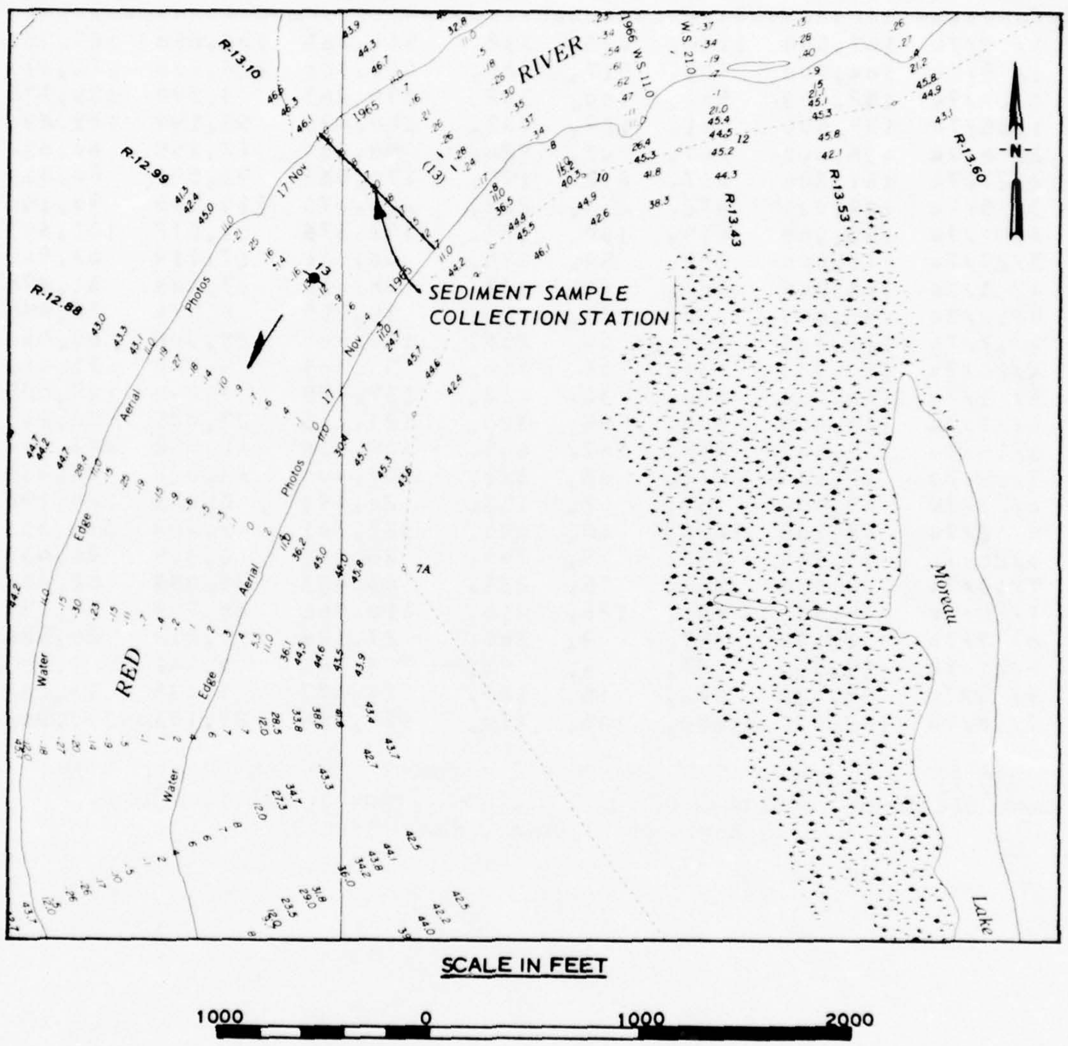

Figure A119. Site location for Red River above Old River Outflow Channel, Louisiana, sediment sample collection station (Source: Sheet 204, Red River Hydrographic Survey, Volume 2, 1965-1968, U. S. Army Engineer District, New Orleans, New Orleans, Louisiana, 1970)

RED RIVER ABOVE OLD RIVER OUTFLOW CHANNEL
SUSPENDED SEDIMENT OBSERVATIONS

DATE MO DA YR	Q 1000 CFS	P.P.M. TOT	P.P.M. SAND	P.P.M. SILT	1000 TONS/DAY TOTAL	1000 TONS/DAY SAND	1000 TONS/DAY SILT
1/ 2/74	167.000	1136.	405.	732.	511.763	182.206	329.557
1/ 9/74	164.000	905.	517.	388.	400.101	228.726	171.375
1/24/74	152.000	562.	180.	382.	230.267	73.890	156.376
1/30/74	159.000	561.	129.	432.	240.490	55.199	185.290
2/ 6/74	136.000	267.	47.	220.	98.089	17.255	80.834
2/27/74	161.000	407.	212.	195.	176.832	92.020	84.813
3/ 5/74	164.000	472.	250.	222.	208.670	110.504	98.166
3/20/74	135.000	419.	140.	278.	152.375	51.072	101.303
3/27/74	118.000	252.	54.	198.	80.066	17.119	62.947
4/ 3/74	108.000	167.	60.	107.	48.639	17.343	31.296
4/10/74	95.000	152.	33.	119.	39.055	8.574	30.480
4/17/74	117.000	320.	64.	256.	100.946	20.082	80.864
4/24/74	100.000	131.	15.	116.	35.353	3.940	31.413
5/ 1/74	116.000	444.	30.	414.	139.025	9.400	129.625
5/ 7/74	119.000	385.	85.	300.	123.646	27.405	96.241
5/15/74	135.000	836.	167.	669.	304.436	60.752	243.684
5/22/74	97.100	410.	88.	322.	107.460	23.024	84.436
6/ 3/74	49.000	155.	2.	153.	20.491	0.293	20.198
6/12/74	88.200	1420.	14.	1406.	337.741	3.408	334.333
6/26/74	13.200	757.	9.	748.	26.942	0.309	26.633
7/10/74	104.000	297.	75.	223.	83.403	21.003	62.400
7/24/74	79.500	541.	126.	416.	116.066	26.909	89.157
8/ 7/74	34.100	297.	9.	288.	27.346	0.819	26.526
8/21/74	13.500	97.	4.	93.	3.545	0.142	3.403
9/ 4/74	38.800	142.	16.	127.	14.877	1.635	13.242
9/18/74	102.000	1380.	106.	1274.	379.696	29.183	350.512

Figure A120. Example of discharge and sediment data for the Red River above Old River Outflow Channel, Louisiana (printout provided by U. S. Army Engineer District, New Orleans)

Red River at Alexandria, Louisiana

Station identification

OWDC No.: 54883

Agency station No.: 04600

Latitude/longitude: 311846/922634

Agency reporting to OWDC: CE

River mile: 104.9 (Mile 0 is at the confluence of the Lower Old and Mississippi rivers; established by the CE in 1967.)

Site description

The station is on the U. S. Highway 165 Bridge (business route) that crosses the Red River at Alexandria (Figure A121). Bayou Rigolette empties into the Red River 1.8 miles upstream. There are levees on both banks and revetment on the right bank between the levee and the river. The river is straight in the vicinity of the station and is navigable for commercial traffic. The gradient of the channel through this reach is 1.1 ft/mile, and the bed material is composed mainly of fine sands. Since the closure of Dennison Dam 31 October 1943 and the subsequent closing of other dams upstream from Alexandria, the flow past this station is considered to be partially controlled.

The discharges of record (1928 to the present) are: maximum - 233,000 cfs, mean - 31,663 cfs; and minimum - 873 cfs. The sediment loads of record (1952 to the present) are: maximum - 2,021,000 tons/day; mean - 260,000 tons/day; and minimum - 26,000 tons/day.

Station chronological record

The station was established in 1952 as part of the program to characterize the sediment regime of the Red River. The chosen site was an established discharge range. The CE New Orleans District (NOD) is responsible for collecting the samples and reducing and publishing the data resulting from the laboratory analysis. Prior to June 1973, the samples were analyzed by the NOD Laboratory and are now analyzed by the USGS Louisiana District Laboratory in Baton Rouge.

Sample and data
collection procedures

Suspended-sediment and bed samples are taken twice each month. Four to five point-integrated samples (at 10, 25, 50, 75, and 90 percent of the depth of the vertical) are taken on three to five verticals equally spaced across the stream. The number of points on each vertical and the number of verticals are determined by instructions provided by the NOD based on the gage reading. The suspended-sediment samples are taken with a US P-46 sampler. The point-integrated samples are taken for 2-min intervals. The discharge is measured with a Gurley velocity meter each day that sediment samples are taken. River stage is measured twice daily with a wire-weight gage attached to the downstream side of the bridge. Prior to 1932, a staff gage was used to measure stage.

Laboratory sample analysis

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reduction procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reporting procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana. An example of data for this station (provided by NOD) is shown in Figure A122.

General information

Additional information on this station can be obtained from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, Louisiana 70160.

Figure A121. Site location for Alexandria, Louisiana, sediment sample collection station (Source: Sheet 163, Red River Hydrographic Survey 1965-1968, Volume 2, U. S. Army Engineer District, New Orleans, New Orleans, Louisiana, 1970)

RED RIVER AT ALEXANDRIA, LA.
SUSPENDED SEDIMENT OBSERVATIONS

DATE	Q 1000	P.P.M.			1000 TONS/DAY		
MO DA YR	CFS	TOT	SAND	SILT	TOTAL	SAND	SILT
10/12/72	3.731	115.	35.	80.	1.159	0.352	0.806
10/26/72	4.796	164.	27.	138.	2.127	0.344	1.784
11/ 9/72	72.403	2148.	424.	1724.	419.382	82.854	336.529
11/24/72	51.654	961.	274.	687.	133.862	38.145	95.717
12/ 7/72	20.616	601.	253.	348.	33.438	14.074	19.364
12/21/72	55.529	1096.	311.	785.	164.092	46.580	117.512
1/ 4/73	27.275	453.	155.	298.	33.343	11.413	21.930
1/18/73	36.971	492.	191.	301.	49.040	19.028	30.012
2/15/73	88.669	2013.	592.	1421.	481.366	141.521	339.846
3/ 1/73	27.452	492.	115.	377.	36.400	8.512	27.887
3/29/73	101.756	1317.	380.	937.	361.380	104.387	256.993
4/19/73	78.100	896.	223.	674.	188.805	46.902	141.903
4/26/73	128.000	1545.	333.	1212.	533.389	114.976	418.413
4/30/73	142.000	1282.	221.	1060.	490.806	84.763	406.042
5/ 3/73	137.000	1361.	386.	975.	502.979	142.732	360.247
5/ 8/73	134.000	1048.	348.	701.	378.769	125.605	253.164
5/10/73	120.000	1095.	342.	753.	354.460	110.741	243.719
5/15/73	121.000	1046.	277.	769.	341.403	90.494	250.909
5/17/73	120.000	1110.	360.	750.	359.256	116.410	242.846
5/22/73	97.500	659.	122.	537.	173.189	32.034	141.155
5/24/73	76.100	797.	143.	655.	163.582	29.245	134.337
5/29/73	43.100	806.	58.	748.	93.627	6.738	86.890
5/31/73	35.400	591.	33.	558.	56.447	3.138	53.309
6/ 5/73	26.400	360.	26.	334.	25.620	1.816	23.804
6/ 7/73	29.700	441.	35.	406.	35.316	2.769	32.548
6/12/73	88.000	2352.	316.	2035.	558.026	75.014	483.012
6/14/73	107.000	1844.	263.	1581.	532.075	75.944	456.132
6/19/73	104.000	1681.	396.	1285.	471.525	111.151	360.375
6/21/73	90.000	1220.	253.	966.	296.012	61.458	234.554
7/12/73	21.834	427.	31.	396.	25.135	1.831	23.303
7/26/73	15.031	98.	5.	93.	3.977	0.206	3.771
9/ 6/73	17.185	493.	63.	430.	22.830	2.911	19.919
9/20/73	23.097	536.	73.	463.	33.384	4.524	28.859
10/ 4/73	27.644	694.	94.	600.	51.737	7.010	44.727

Figure A122. Example of sediment data for Alexandria, Louisiana (printout provided by U. S. Army Engineer District, New Orleans)

Red River at Shreveport, Louisiana

Station identification

OWDE No.: 54882

Agency station No.: 04225

Latitude/longitude: 323055/934425

Agency reporting to OWDC: CE

River mile: 277.6 (Mile 0 is at the confluence of the Lower Old and Mississippi rivers; established by the CE in 1967.)

Site description

The sediment sample collection station is on the U. S. Highway 80 Bridge that crosses the Red River between Shreveport and Bossier City, 0.2 mile downstream from the confluence of Cross Bayou and the Red River (Figure A123). The gaging station is 0.2 mile downstream on the Illinois Central Railroad bridge. The left bank is protected by the Bossier City front revetment. There are rock groins on the left bank farther downstream. The stations are in a straight reach of the river, and the streambed gradient is 1.1 ft/mile. The Red River is navigable for commercial traffic in this reach. The streambed material consists of medium and fine sands. The discharge is somewhat regulated by Denison Dam (closed 31 October 1943), Texarkana Dam (closed 1953), and Millwood Dam (closed 16 August 1966). The discharges of record (from 1928) prior to 16 August 1966 are: maximum - 303,000 cfs; and minimum - 690 cfs. (No mean discharge value for the period 1928 - 16 August 1966 is available.) After 16 August 1966, the discharges of record (to the present) are: maximum - 165,000 cfs; mean - 26,100 cfs; and minimum - 1,600 cfs. No sediment load records are available.

Station chronological record

Information is identical to that presented for the Red River sediment sample collection station at Alexandria, Louisiana, except that the sediment station was established in 1966.

Sample and data
collection procedures

Suspended-sediment and bed-material samples were taken once a month through 1974 on a single vertical 450 ft from the right bank. Samples were taken at 25, 50, and 75 percent of the depth of the vertical. Since the beginning of 1975, samples have been taken weekly. Sediment samples are now taken on three verticals with five point-integrated samples on each vertical. The samples are taken at 10, 25, 50, 75, and 90 percent of the depth of the vertical. The verticals are at 250, 450, and 650 ft from a reference marker on the right bank. Sediment samples are taken with a US P-61 sampler. (Prior to 15 April 1974, a US P-46 sampler was used.) Bed-material samples are taken with a drag bucket.

Discharge is measured with a Gurley current meter each day the suspended-sediment samples are taken.

River stage was measured with a staff gage prior to 1934; since that date, a wire-weight gage has been used. A Telemark device was added to the installation in 1955. The stage reading is now made via direct-line telephone by a paid observer, whose services are jointly funded by the CE (50 percent) and the National Weather Service (50 percent).

Laboratory sample analysis

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reduction procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reporting procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

General information

Additional information on this station can be obtained from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, Louisiana 70160.

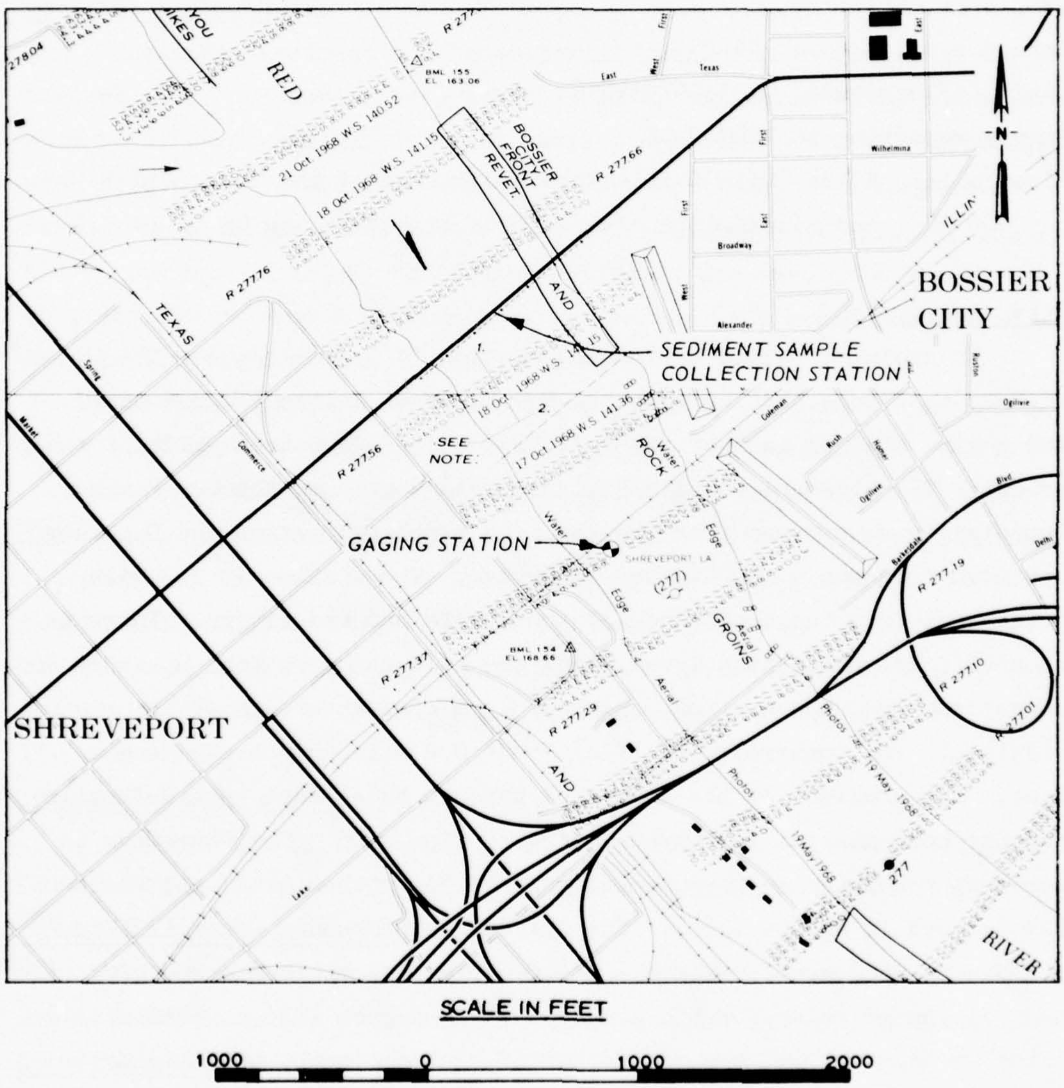

Figure A123. Site location for Shreveport, Louisiana, sediment sample collection station (Source: Sheet 83, Red River Hydrographic Survey, 1967-1969, Volume 1, U. S. Army Engineer District, New Orleans, New Orleans, Louisiana, 1970)

Red River at Fulton, Arkansas

Station identification

OWDC No.: 54777

Agency station No.: 04075

Latitude/longitude: 333626/934856

Agency reporting to OWDC: CE

River mile: 401.8 (Mile 0 is at the confluence of the Lower Old and Mississippi rivers; established by the CE in 1967.)

Site description

Th sediment sample collection station is 0.3 mile above the U. S. Highway 67 Bridge that crosses the Red River at Fulton (Figure A124). The gaging station is near the left bank on the downstream side of the bridge. The Missouri-Pacific Railroad bridge crosses the Red River immediately downstream from the sediment sampling station and 0.2 mile upstream from the U. S. Highway 67 Bridge. The station is 1.3 mile downstream from the confluence of the Little and Red rivers. There is an artificial protection levee along the left bank (Fulton) upstream and downstream from the station, which is in a straight reach of the river (navigable for commercial traffic) about 0.2 mile downstream from a bend. The gradient of the streambed through this reach is 1.0 ft/mile, and the bed material is composed of very fine sand. The discharge is somewhat regulated by Denison Dam (closed 31 October 1943) and Millwood Dam (closed 16 August 1966). The discharges of record (from 1927 to 16 August 1966) are: maximum - 338,000 cfs; and minimum - 390 cfs. (No mean discharge value for the period 1927-16 August 1966 is available.) After 16 August 1966, the discharges of record (to the present) are: maximum - 165,000 cfs; mean - 17,680 cfs; and minimum - 1,000 cfs. The sediment loads of record (1966 to the present) are: maximum - 2,541,415 tons/day; mean - 83,900 tons/day; and minimum - 407 tons/day.

Station chronological record

Information is identical to that presented for the Red River

sediment sample collection station at Alexandria, Louisiana, except that the sediment station was established in 1966.

Sample and data
collection procedures

Suspended-sediment and bed-material samples were taken monthly through 1973; no samples were taken in 1974; beginning in 1975 samples have been taken weekly. Sediment samples are taken on three verticals with five point-integrated samples on each vertical. The samples are taken from a cableway and boat with a US P-46 sampler at 10, 25, 50, 75, and 90 percent of the depth of the vertical. The verticals are at 250, 350, and 450 ft from a reference marker on the left bank. Bed-material samples are taken with a drag bucket.

Discharge is measured with either a Gurley or a Price current meter each day the suspended-sediment samples are taken.

River stage was measured with a staff gage prior to 1932; since that date, a wire-weight gage has been used. A Stevens A-35B graphical recorder and Telemark device were added to the installation in 1965 to continuously monitor stage. The daily measurements are made by means of direct-line telephone by a paid observer, whose services are funded jointly by the CE (50 percent) and the National Weather Service (50 percent).

Laboratory sample analysis

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reduction procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana.

Data reporting procedures

Information is identical to that presented for the Atchafalaya River sediment sample collection station at Simmesport, Louisiana. An example of data for this station (provided by the NOD) is shown in Figure A125.

General information

Additional information on this station can be obtained from: U. S. Army Engineer District, New Orleans, Hydraulics and Hydrologic Branch, P. O. Box 60267, New Orleans, Louisiana 70160.

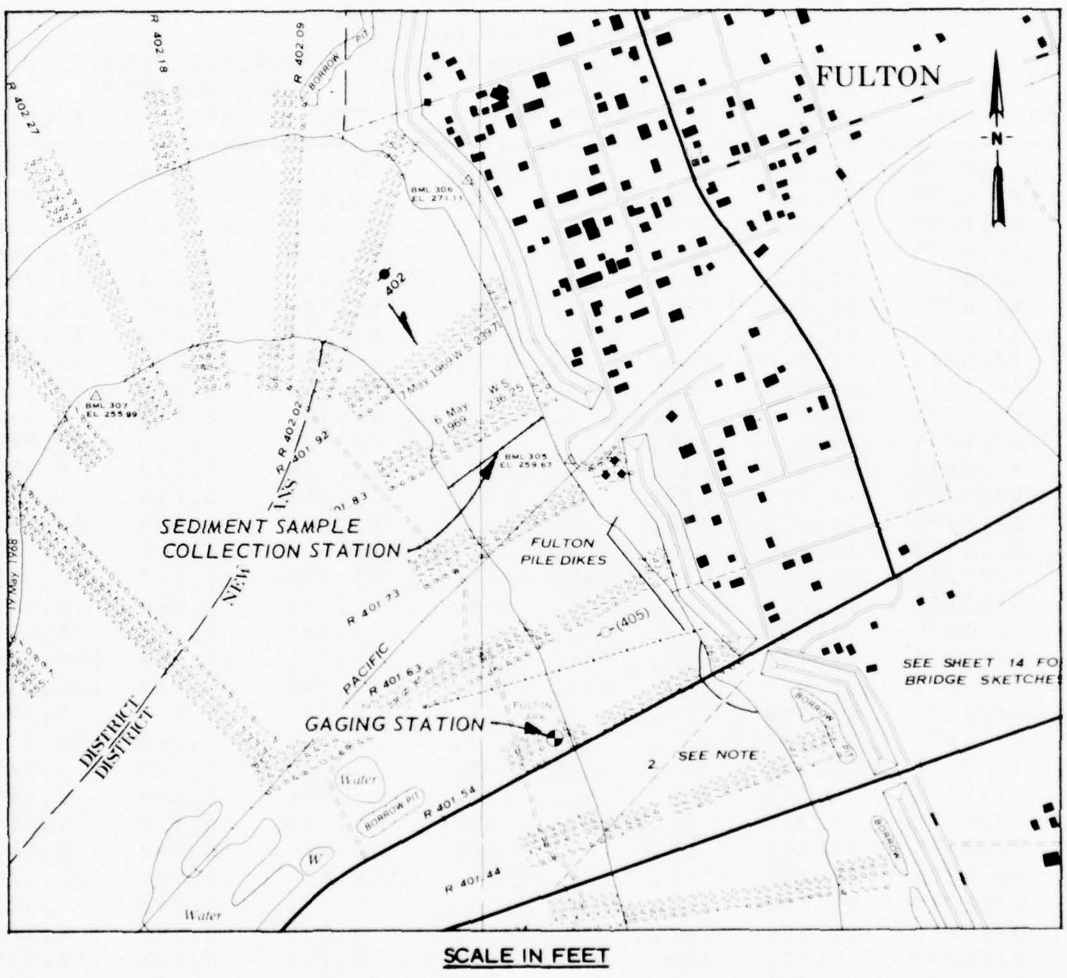

Figure A124. Site location of Fulton, Arkansas, sediment sample collection station (Source: Sheet 17, Red River Hydrographic Survey, 1967-1969, Volume 1, U. S. Army Engineer District, New Orleans, New Orleans, Louisiana, 1970)

RED RIVER AT FULTON

SUSPENDED SEDIMENT OBSERVATIONS

DATE MO DA YR	Q 1000 CFS	P.P.M. TOT	P.P.M. SAND	P.P.M. SILT	1000 TONS/DAY TOTAL	1000 TONS/DAY SAND	1000 TONS/DAY SILT
1/28/75	8,200	229.	68.	161.	5,068	1,506	3,562
2/ 4/75	93,400	989.	16.	973.	249,218	4,121	245,098
2/11/75	70,800	776.	320.	456.	148,178	61,122	87,056
2/18/75	36,900	265.	103.	162.	26,406	10,240	16,166
2/25/75	21,700	321.	120.	201.	18,796	7,043	11,753
3/ 4/75	38,400	507.	127.	380.	52,520	13,149	39,371
3/18/75	51,200	500.	213.	287.	68,979	29,388	39,591
3/25/75	31,800	182.	8.	173.	15,604	0,727	14,877
4/ 1/75	64,600	226.	13.	213.	39,319	2,204	37,116
4/ 8/75	53,800	78.	4.	74.	11,386	0,643	10,743
4/15/75	35,000	239.	0.	239.	22,589	0.	22,589
4/22/75	17,800	231.	27.	204.	11,079	1,287	9,792
4/29/75	4,200	132.	1.	130.	1,491	0,014	1,477
5/ 6/75	50,200	172.	4.	168.	23,217	0,483	22,734
5/13/75	34,200	304.	53.	251.	28,016	4,845	23,171
5/20/75	26,700	610.	155.	455.	43,898	11,127	32,772
5/27/75	11,700	54.	1.	53.	1,706	0,020	1,686
6/ 3/75	53,900	719.	42.	677.	104,561	6,157	98,404
6/10/75	49,700	1453.	261.	1192.	194,711	34,961	159,749
6/17/75	58,900	1196.	409.	787.	189,996	64,978	125,018
6/24/75	28,900	129.	9.	121.	10,077	0,683	9,394
7/ 1/75	34,100	432.	12.	420.	39,716	1,140	38,576
7/ 8/75	13,200	105.	6.	99.	3,754	0,229	3,525
7/15/75	4,700	280.	98.	181.	3,546	1,246	2,299
7/22/75	5,900	70.	7.	63.	1,109	0,106	1,003
7/29/75	10,300	83.	9.	74.	2,310	0,262	2,048
8/ 5/75	28,200	1747.	166.	1580.	132,826	12,651	120,175
8/12/75	11,500	182.	2.	180.	5,653	0,072	5,581
8/19/75	11,500	162.	5.	157.	5,009	0,145	4,864
8/26/75	9,100	126.	5.	121.	3,100	0,126	2,975
9/ 2/75	4,700	78.	5.	74.	0,994	0,060	0,934
9/ 9/75	4,900	83.	3.	80.	1,095	0,033	1,061
9/16/75	4,000	84.	2.	81.	0,902	0,024	0,878
9/23/75	8,800	159.	8.	152.	3,783	0,182	3,600

Figure A125. Example of sediment data for Fulton, Arkansas (print-out provided by U. S. Army Engineer District, New Orleans)

Red River at Dekalb, Texas

Station identification

OWDE No.: 70810

Agency station No.: 07336820

Latitude/longitude: 334115/944139

Agency reporting to OWDC: Texas Water Development Board

River mile: 556.9 (Mile 0 is at the junction of the Red and Atchafalaya rivers and Lower Old River; established by the CE in 1969.)

Site description

The station is at the U. S. Highway 259 Bridge on the Texas-Oklahoma State line 13 miles north of Dekalb, Texas (Figure A126). The streambed is composed mostly of coarse sand and gravel, and the gradient of the streambed is approximately 0.9 ft/mile. The channel is not controlled, and the stream is free to meander, except for stabilization at the bridgeheads. The channel section in the vicinity of the site is straight, and there are no structures or tributaries upstream for 50 miles. The stream is not navigable for commercial traffic. The flow is partially regulated by Denison Dam 169 river miles upstream. The discharges measured during the period of record (1967 to the present) are: maximum - 189,000 cfs; mean - 9,736 cfs; and minimum - 431 cfs. The sediment loads of record (1969 to the present) are: maximum - 117,800 tons/day; mean - 7,800 tons/day; and minimum - 300 tons/day.

Station chronological record

This station was primarily established in February 1969 to compile a record of suspended-sediment characteristics of Red River streamflow at a proposed diversion point contained in the Texas Water System where 617,000 acre-ft of water would be diverted annually to Naples Reservoir in the Sulphur River Basin. The station record also affords additional definition of the suspended-sediment regime of the Red River. The Texas Water Development Board (TWDB) is responsible for collecting and analyzing the samples and for reducing and publishing the resulting data.

Sample and data
collection procedures

A sample has been taken daily since 1 February 1969 by a paid observer. A Texas-type sampler is used, which consists of a container that holds an 8-oz bottle mounted on a rod attached to a lead fish. The sampler is attached to a rope and is lowered by hand to a depth of 1 ft below the surface of the water. The observer records the time, date, gage height, and station name and number on the bottle label. River stage is measured with a Stevens A-35 continuous recorder and a Fisher-Porter digital recorder.

Laboratory sample analysis

The samples are analyzed in the soils laboratory maintained by the TWDB. Laboratory data are summarized on the form TWDB ESS3 (Suspended-Sediment Computation Form E-SS-3, Figure A127).

When the samples are received in the laboratory, the station number (columns 1-8), date (columns 9-14), time, and gage height are recorded on the computation form. The bottles are then weighed and recorded to the nearest 0.1 g (columns 23-28) prior to filling. Then the bottle and sample are weighed and recorded to the nearest 0.1 g (columns 29-34). The samples are filtered through a crucible with the glass fiber filter set in the bottom. The crucible and filter are then dried in an oven set at 130°C for 2 hr and then are placed in a desiccator to cool for 2 hr more. The filter is then weighed and the weight recorded to the nearest 0.0001 g (columns 35-42).

Data reduction procedures

The computation forms (E-SS-3) are turned over to the Data Processing Division of the TWDB. These data are keypunched into computer cards for computation as follows:

$$TW = 2700 \times Q$$

where

TW = weight of water passing the station, tons/day
Q = discharge, cfs

Then,

$$\%DS = \frac{W_{DS}}{W_S}$$

where

$\%DS$ = percent dry sediment

W_{DS} = weight of the dry sediment, where W_{DS} is the value in columns 35-42 subtracted from the value in columns 43-50 of TWDB E-SS-3

W_S = weight of the sample, where W_S is the value in column 23-28 subtracted from the value in columns 29-34 of form TWDB E-SS-3

Then,

$$TS = TW \times \%DS$$

where TS = sediment load passing station, tons/day.

Data reporting procedures

Data received from the Data Processing Division are checked and verified. The data are then compiled into annual or multiannual reports, which show the monthly and annual streamflow in acre-ft, suspended-sediment load in tons and acre-ft, and dry sediment in percent by weight (Reference 42). Discharge data are also published in Reference 43. Figure A128 shows a sample of data reported for this station.

General information

Additional information on this station can be obtained from: Texas Water Development Board, P. O. Box 13087, Capital Station, Austin, Texas 78711.

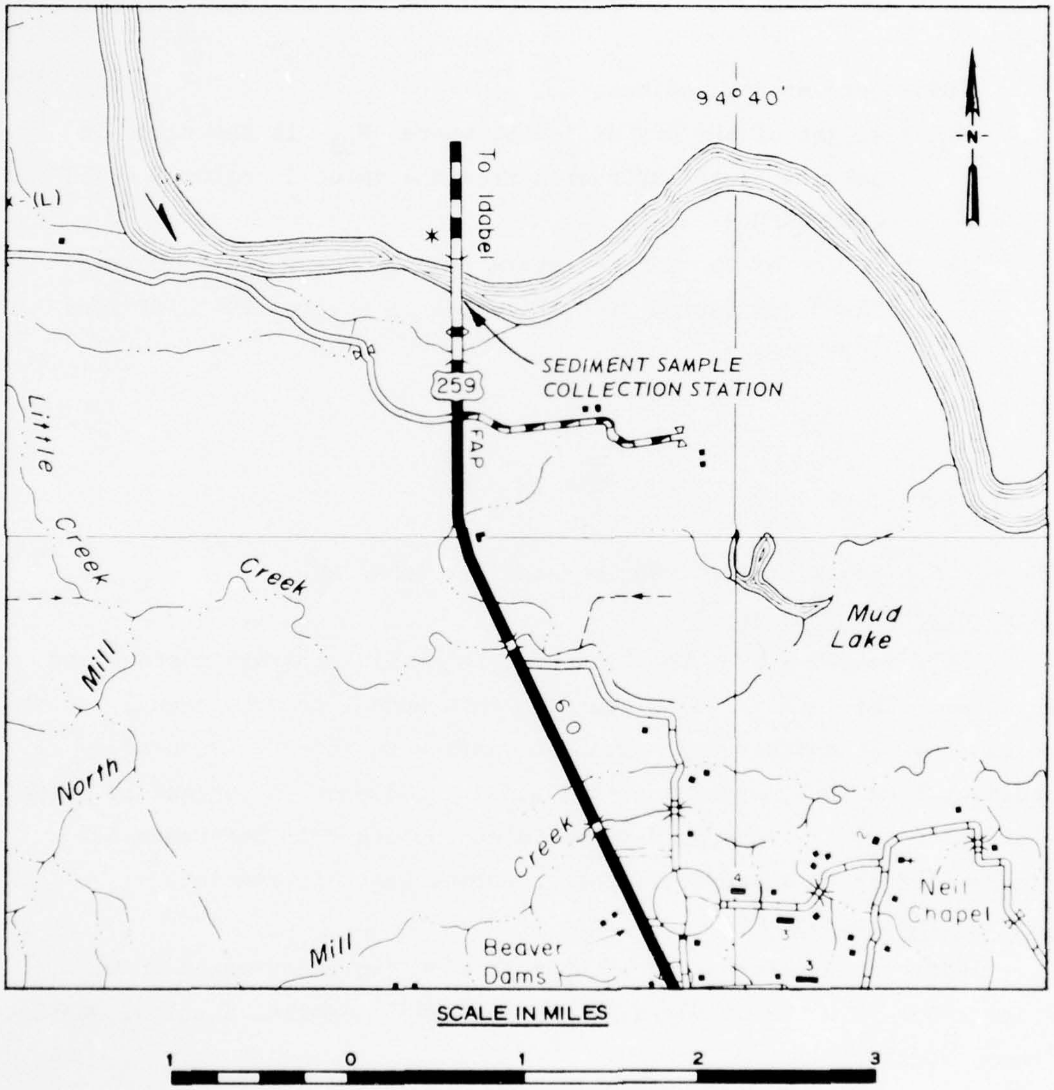

Figure A126. Site location for Dekalb, Texas, sediment sample collection station (Source: General Highway Map, Bowie County, Texas, State Department of Highway and Public Transportation, Austin, Texas, 1975)

SUSPENDED - SEDIMENT COMPUTATION FORM

STREAM Red CREEK RIVER - STATION AT NEAR - Dekalb, Texas

MONTH October WATER YEAR Oct 1973 → Sept 1974

1 - 8	9 - 14						15 - 22	23 - 28	29 - 34	35 - 42	43 - 50		51 - 54				55 - 57			58	59
	DATE												TYPE				ORDER				
STATION NUMBER	MONTH	DAY	YEAR	TIME	M	GAGE HEIGHT	FLOW CFS	WEIGHT OF BOTTLE	WEIGHT OF BOTTLE + SAMPLE	WEIGHT OF FILTER	WEIGHT OF FILTER + SEDIMENT	FILTER NO.	REGULAR	ESTIMATE	MULTIPLE	MISSING	OTHER	LAST MULT	LAST DATA	LEAP YEAR	IDEAL MONTH
07336820	11	29	73	2:45	pm	24.75	81,600	373.0	622.9	0 0256	0.0349										

TWDBE 55-3 (Rev. 3-20-72)

Figure A127. Suspended-sediment computation form used by Texas Water Development Board Soils Laboratory

RECORD PERIOD	STREAMFLOW ACRE-FEET	SUSPENDED-SEDIMENT LOAD OF STREAM			DRY SEDIMENT PCT BY WEIGHT
		TONS	TONS PER SQ MI	ACRE-FEET	
WATER YEAR 1970					
OCT	503900	310300	--	204	.0452
NOV	252300	36610	--	24	.0107
DEC	309700	148000	--	97	.0351
JAN	551900	390700	--	256	.0520
FEB	505700	429800	--	282	.0624
MAR	1162000	1360000	--	892	.0860
APR	931200	867900	--	569	.0685
MAY	615900	353400	--	232	.0422
JUNE	485000	279600	--	183	.0424
JULY	160100	9740	--	6	.0045
AUG	217000	18860	--	12	.0064
SEPT	286800	125500	--	82	.0321
SUMMARY	5981000	4330000	105	2840	.0532

Figure A128. Example of sediment data for Dekalb, Texas (Source: Suspended-Sediment Load of Texas Streams, October 1965-September 1971, Texas Water Development Board, Austin, Texas)

Red River at Arthur City, Texas

Station identification

OWDC No.: 17332

Agency station No.: 07335500

Latitude/longitude: 335232/953008

Agency reporting to OWDC: CE

River mile: 633.1 (Mile 0 is at the confluence of the Lower Old and Mississippi rivers; established by the CE in 1967.)

Site description

The station is at the U. S. Highway 271 Bridge, 15 miles north of Paris, Texas, 9 miles south of Hugo, Oklahoma, 10.6 miles below the confluence of the Red River with Muddy Boggy, and 92.8 miles below Denison Dam (Figure A129). The bed material consists mostly of coarse sand and gravel, and the gradient of the bed is nearly flat. The channel is not controlled, and the stream is free to meander, except for stabilization at the bridgeheads. The stream is not navigable for commercial traffic through this reach. The flow has been regulated by Denison Dam since 31 October 1943. Some regulation by Pat Mayse Dam on Sanders Creek, a right-bank tributary, has existed since September 1967.

The discharges of record from 1905 to 31 October 1943 were: maximum - 222,000 cfs; mean - 6,880 cfs; and minimum - 170 cfs. From 31 October 1943 to the present the discharges of record are: maximum - 134,000 cfs; mean - 7,770 cfs; and minimum - 130 cfs. The sediment loads of record (1938 to 31 October 1943)are: maximum - 957,000 tons/day; and minimum - 50 tons/day. (No mean value is available.) The sediments loads of record after 31 October 1943 are: maximum - 697,000 tons/day; mean - 25,800 tons/ day; the minimum - 38 tons/day.

Station chronological record

The Red River above Lake Texoma (Denison Dam) is a heavy-sediment-bearing stream originating in eastern New Mexico, flowing through the Texas Panhandle, and forming the boundary between Oklahoma and Texas. Studies on the sediment-trapping capability of Lake Texoma emphasized

the need for sediment data on the Red River both upstream and downstream from the damsite. The U. S. Highway 271 Bridge, 93 miles downstream from Denison Dam, was selected in 1938 as an ideal location for determining the sediment recovery capability of the Red River downstream from the dam due to bank and streambed erosion and contributions from tributary streams.

The CE Tulsa District (TD) is responsible for collecting the samples and reducing the data from the laboratory analysis. Sediment data are not published but are provided by the TD upon request. The samples are analyzed in the CE Southwestern Division Laboratory in Dallas, Texas.

Sample and data
collection procedures

Samples are taken irregularly at three locations on the bridge, each representing a cross-sectional area of the stream that passes one third of the streamflow. A Texas sampler was used prior to 1949 (see Red River at Dekalb, Texas, for a description of this sampler). A depth-integrated suspended-sediment sampler (US D-49) is now used. The instrument is suspended on a hanger bar attached to a 1/8-in. steel cable and is lowered and raised by means of a reel attached to the bridge. To obtain a sample, a bottle is inserted in the sampler, and the instrument is lowered at a uniform rate from the water surface to the bottom of the stream, instantly reversed, and then raised again to the water surface at a uniform rate. The sampler continues to take its sample throughout the time of submergence. A hand sampler (US DH-48) is used when taking low-flow samples.

River stage was measured prior to 1940 with a staff gage and a wire-weight gage. A Stevens automatic stage recorder was installed in 1940 and is still in use.

Laboratory sample analysis

Information is identical to that presented for the Arkansas River sediment sample collection station at Little Rock, Arkansas.

Data reduction procedures

The sediment-concentration data together with the discharge

determined from the gage measurement are tabulated chronologically. The samples are then grouped by discharge values. The discharge and sediment concentration values for each group are summed and averaged to provide an average value of concentration for various discharges distributed throughout the range of flow. A discharge-concentration curve is then plotted.

The discharge-concentration curve can be applied to daily discharges to obtain daily sediment loads. An average annual-sediment-load curve can be plotted from the discharge-concentration curve and a flow duration curve or table. Gradation data can be applied to the sediment-load curve to obtain the particle-size distribution of the sediment load.

Data reporting procedures

Sediment data are not regularly reported to other offices. Data are used by the TD for determining sediment movement in the Red River. A chronological tabulation of stream discharges and sediment concentrations is provided upon request. A printout of sample data (provided by the TD) is presented in Figure A130. Discharge data are provided for the USGS Oklahoma District and are published in References 12 and 44.

General information

Records for this station are considered to be good. Additional information on this station can be obtained from: U. S. Army Engineer District, Tulsa, Engineering Division, P. O. Box 61, Tulsa, Oklahoma 74102.

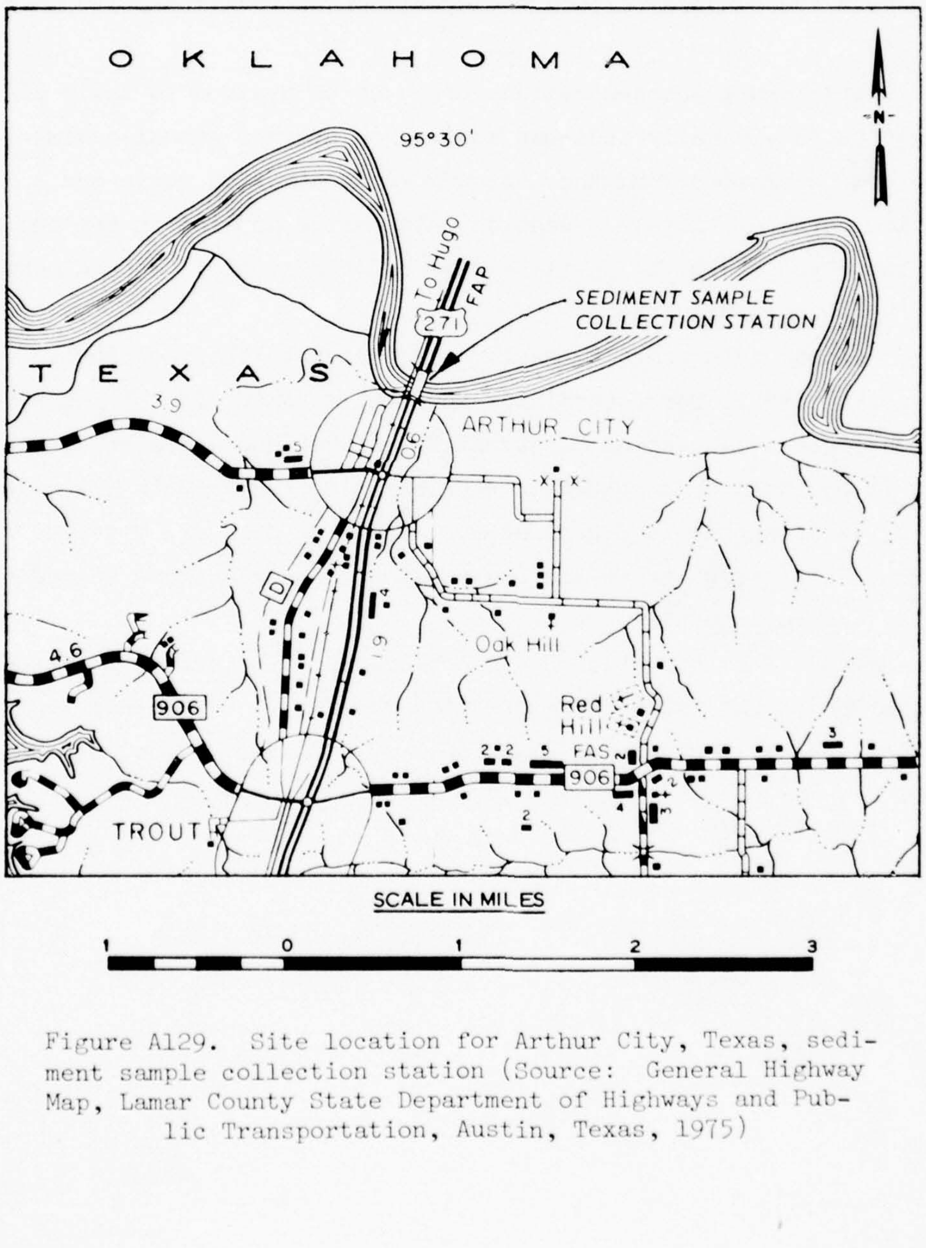

Figure A129. Site location for Arthur City, Texas, sediment sample collection station (Source: General Highway Map, Lamar County State Department of Highways and Public Transportation, Austin, Texas, 1975)

	DATE	Q (CFS)	PERCENT SEDIMENT	DATE	Q (CFS)	PERCENT SEDIMENT
ARTHUR	11972	7430	.011	20272	7370	.010
ARTHUR	20772	5560	.006	22972	5410	.006
ARTHUR	30972	3930	.038	31672	3680	.006
ARTHUR	32772	2930	.006	40572	2770	.014
ARTHUR	41772	1850	.006	42572	2560	.024
ARTHUR	50372	3730	.020	51072	1020	.012
ARTHUR	52672	4000	.008	60572	2640	.011
ARTHUR	62872	3950	.009	71372	1790	.009
ARTHUR	72472	2490	.008	80372	1320	.016
ARTHUR	82172	1710	.010	100572	1210	.004
ARTHUR	101272	2830	.011	102572	6720	.060
ARTHUR	110172	41000	.094	110372	29700	.051
ARTHUR	110472	21700	.039	110972	18400	.040
ARTHUR	111672	11500	.027	11873	5860	.024

Figure A130. Example of sediment data for Arthur City, Texas (printout provided by U. S. Army Engineer District, Tulsa)

Red River at Colbert, Oklahoma

Station identification

OWDC No.: None

Agency station No.: None, only name used by agency

Latitude/longitude: 334904/963120

Agency reporting to OWDC: CE

River mile: 722.6 (Mile 0 is at the confluence of the Lower Old and Mississippi rivers; established by the CE in 1967.)

Site description

The station is at the Old Colbert Bridge across the Red River, 2 miles south of Colbert, Oklahoma, 1.3 miles downstream from Sand Creek, and 2.9 miles downstream from Denison Dam (Figure 131). The channel is straight for about 0.5 mile above and below the bridge. The banks are composed of sand and are subject to sloughing. Both banks are moderately wooded, with the left bank being high and not subject to overflow. The right bank is lower and is overtopped during high flows. The streambed consists of mostly a coarse sand and gravel, and some shifting occurs at all stages. The stream is not navigable for commercial traffic through this reach. The discharge passing the station has been controlled by Denison Dam since 31 October 1943. Discharges of record from 1906 to 31 October 1943 are: maximum - 201,000 cfs; mean - 5,500 cfs; and minimum - 75 cfs. After 31 October 1943, the discharges of record (to 1960) are: maximum - 96,200 cfs; mean - 4,740 cfs; and minimum - 12 cfs. The sediment loads of record (from 1930 to 31 October 1943) are: maximum - 2,417,000 tons/day; mean - 30,400 tons/day; and minimum - 42 tons/day. The sediment loads of record from 31 October 1943 to 1960 are: maximum - 91,000 tons/day; mean - 2,200 tons/day; and minimum - 1 ton/day.

Station chronological record

Information is identical to that presented for the Red River sediment sample collection station at Arthur City, Texas, except that this sediment station was established in 1930 at a stream-gaging station with

a record dating to 1906, and its operation was discontinued in 1960.

Sample and data collection procedures

Between September 1930 and the closure of Denison Dam, 261 sediment samples were taken by the same procedures as those presented for the Red River sediment sample collection station at Arthur City, Texas.

River stage was measured prior to 1934 with a staff gage; after 1934, a Stevens automatic stage recorder was used until the station was closed in 1960. A Type A wire gage was also used after 1936 and a staff gage after 1942.

Laboratory sample analysis

Information is identical to that presented for the Arkansas River sediment sample collection station at Little Rock, Arkansas.

Data reduction procedures

Information is identical to that presented for the Red River sediment sample collection station at Arthur City, Texas.

Data reporting procedures

Information is identical to that presented for the Red Rier sediment sample collection station at Arthur City, Texas. A printout of smple data (provided by the TD) is presented in Figure A132.

General information

Approximately 1100 additional samples were taken from August 1930 to August 1931, and 880 samples from May 1937 to September 1939 by the USGS.

Additional information on this station can be obtained from: U. S. Army Engineer District, Tulsa, Engineering Division, P. O. Box 61, Tulsa, Oklahoma 74102.

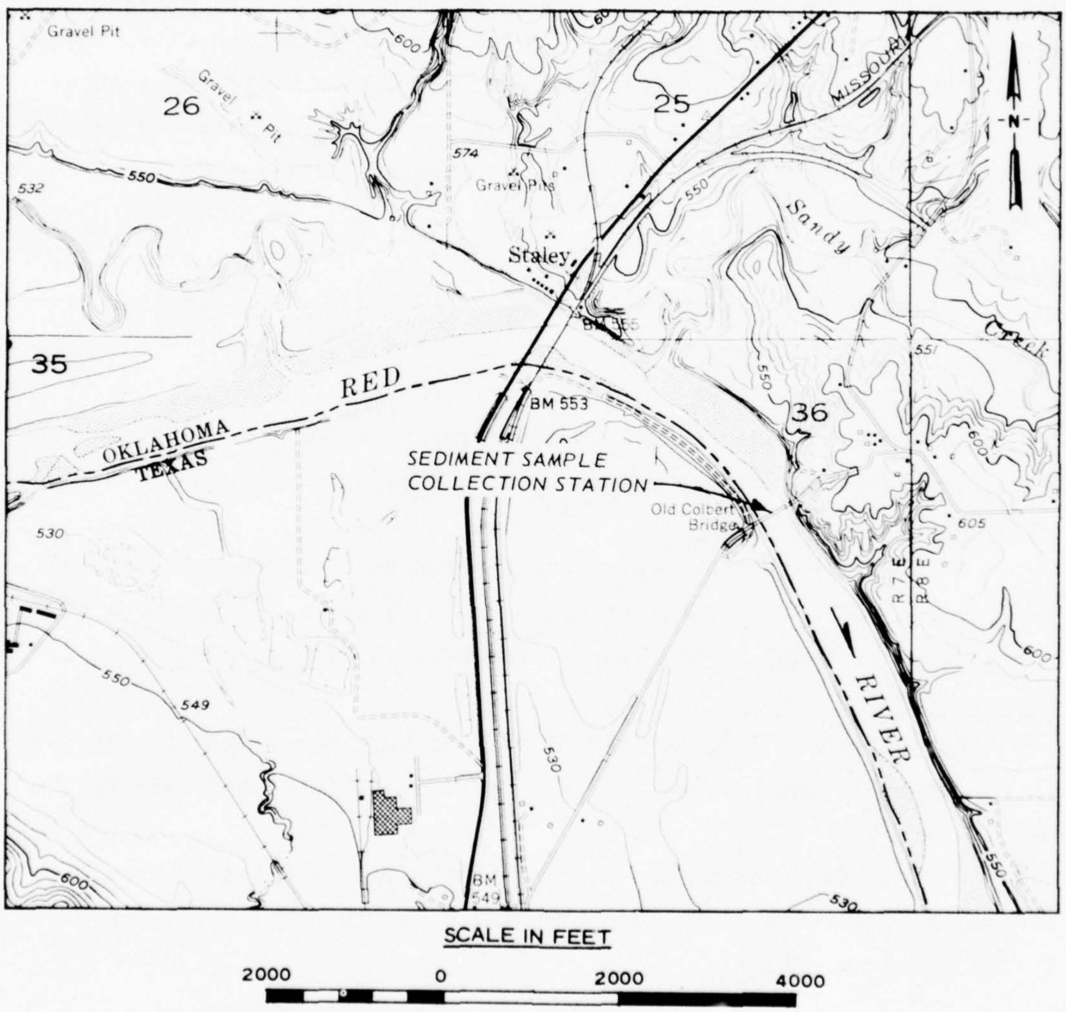

Figure A131. Site location for Colbert, Oklahoma, sediment sample collection station (Source: USGS Quadrangle Map for Denison Dam, Texas-Oklahoma, 1959)

	DATE	Q (CFS)	PERCENT SEDIMENT	AIR TEMP.	WATER TEMP.
450	41361	11000.	0.001	0	0
451	42761	3910.	0.001	0	0
452	51961	5150.	0.001	0	0
453	53161	4220.	0.001	0	0
454	62761	7730.	0.001	0	0
455	70761	8420.	0.001	0	0
456	81461	4360.	0.001	0	0
457	91461	8710.	0.001	0	0
458	100261	5360.	0.017	0	0
459	10161	11200.	0.001	0	0
460	112461	10900.	0.001	0	0
461	120161	10700.	0.001	0	0
462	11862	3640.	0.001	0	0
463	12662	4410.	0.001	0	0
464	20162	4660.	0.001	0	0
465	20862	106.	0.001	0	0
466	42662	125.	0.007	0	0
467	61262	43000.	0.010	0	0
468	61662	32900.	0.024	0	0
469	61962	20300.	0.011	0	0

Figure A132. Example of sediment data for Colbert, Oklahoma (printout provided by U. S. Army Engineer District, Tulsa)

Republican River Below Milford Dam, Kansas

Station identification

OWDC No.: 56831

Agency station No.: 253-3

Latitude/longitude: 390440/965330

Agency reporting to OWDC: CE

River mile: 7.7 (Mile 0 is at the confluence of the Smoky Hill and Republican rivers; established by the CE in 1969. Mile 0 of the Smoky Hill and Republican rivers are at mile 170.4 on the Kansas River (at termination).

Site description

The sediment sample collection station was at the end of the outlet tunnel downstream from Milford Dam (Figure A133). The dam, a compacted earthfill structure 6300 ft long and 140 ft above the streambed, is 5 miles northwest of Junction City, Kansas. Storage in Milford Lake started on 16 January 1967. The streambed material in the vicinity of the station consists of sand, gravel, and boulders, and the gradient of the channel is 3.4 ft/mile. Fort Riley, Kansas, is on the left bank. Riprap has been placed on the banks for approximately 1.5 miles downstream from the station. There are several sand dredging operations downstream from the station; also, there is limited agriculture in the area. The gaging station is 1.7 miles below Milford Dam on the downstream side of the U. S. Highway 77 Bridge that crosses the Republican River northwest of Junction City, Kansas (mile 6.0). Annual soil loss due to erosion upstream from the sediment station is 500-1,000 tons/square mile. The natural streamflow is affected by irrigation development above the sediment station and by reservoirs in Colorado, Nebraska, and Kansas. The discharges of record (1963-1967) prior to closing of the dam are: maximum - 17,200 cfs; mean - 675 cfs; and minimum - 9.0 cfs. No sediment data were obtained from this reach prior to closing of the dam. The discharges of record after the dam was closed

(16 January 1967 to the present) are: maximum - 12,600 cfs; mean - 1,020 cfs; and minimum - 15 cfs. The sediment loads of record (1967-1974) are: maximum - 11,073 tons/day; mean - 84 tons/day, and minimum - 0.81 ton/day.

Station chronological record

The sediment sample collection station was established in May 1967 by the CE Kansas City District (KCD) to monitor the sediment load and thus determine the efficiency of the reservoir as a sediment trap. The samples were collected by the KCD personnel stationed at the reservoir; data were reduced and reported by the KCD. The agencies responsible for sample analysis were as follows:

a. The KCD Soils Laboratory (1967 - May 1973).
b. The CE Missouri River Division Soils Laboratory (May 1973 - April 1974).
c. The USGS Soils Laboratory (April 1974 - September 1974).

Sample and data collection procedures

Samples were collected with a milk bottle (grab sample) once a week. River stage has been measured since 1967 to the present with a Fisher-Porter automatic digital recorder (Model 154) and a Stevens graphical recorder, both driven by a bubble gage (manometer). A wire-weight gage was also used from 1968 to 1974.

Laboratory sample analysis

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Suspended-sediment loads are published in Reference 11. Discharge data are published in Reference 10. Figures A134 and A135 show samples of the data reported for this station.

General information

Sediment and discharge records for this station are considered

good. Additional information on this station can be obtained from: U. S. Army Engineer District, Kansas City, Hydrologic Engineering Branch, Water Control Section, 700 Federal Building, 601 East Twelfth Street, Kansas City, Missouri 64106.

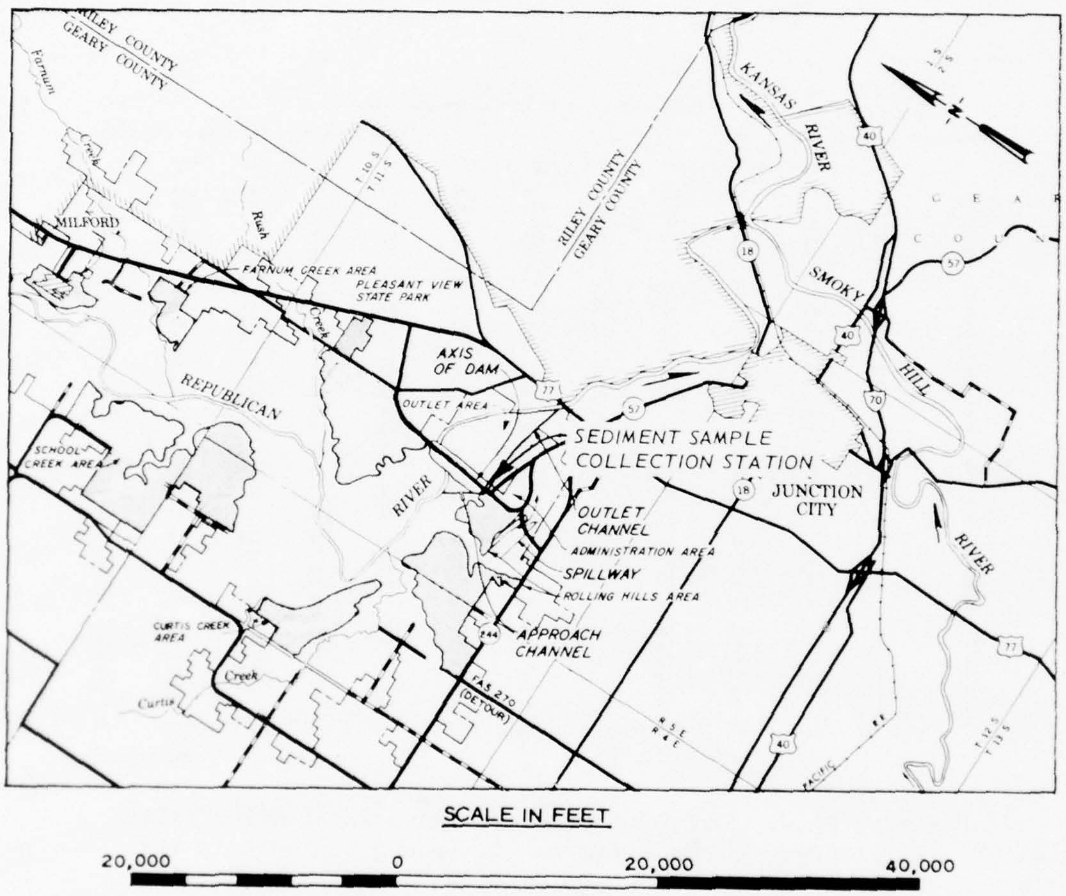

Figure A133. Site location for below Milford Dam, Kansas, sediment sample collection station (Source: 1975 Project Maps, Flood Control Projects, Sheet 21, U. S. Army Engineer District, Kansas City)

REPUBLICAN RIVER AT MILFORD RESERVOIR, KANSAS

SUSPENDED SEDIMENT LOAD - TONS

WATER YEAR OCT 1968 - SEP 1969

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	29	20	17	41	27	135	49	97	203	54	216	16
2	29	19	27	41	27	135	49	97	270	81	216	16
3	37	24	20	41	27	135	49	97	371	108	72	142
4	43	20	17	41	27	135	49	50	67	81	54	243
5	93	20	20	41	27	135	49	27	41	81	17	142
6	108	23	17	41	27	135	49	27	253	54	14	54
7	108	27	17	41	27	135	49	27	189	54	14	27
8	79	27	18	41	27	270	32	27	189	54	14	27
9	79	20	27	41	27	405	27	27	189	54	12	27
10	79	40	22	29	27	270	5	64	65	54	14	27
11	60	54	27	8	45	113	3	81	54	54	14	27
12	40	54	25	8	54	95	5	122	54	136	14	27
13	20	25	21	8	54	95	27	162	54	162	14	16
14	20	20	27	8	54	95	27	203	54	162	27	11
15	40	40	17	8	54	95	27	122	54	108	27	11
16	34	54	27	5	54	95	47	81	54	108	20	8
17	54	54	20	5	32	189	54	41	24	34	19	8
18	27	54	27	12	27	86	54	41	22	27	19	8
19	37	20	27	14	18	99	54	41	22	27	19	8
20	86	20	27	14	16	3	81	41	51	27	19	8
21	88	17	27	14	16	5	81	16	54	196	19	8
22	79	17	27	14	16	24	108	14	54	216	19	8
23	60	17	27	14	16	27	54	50	54	216	10	8
24	40	21	27	14	16	27	62	380	54	216	10	16
25	51	27	42	14	16	122	68	405	54	324	10	16
26	31	17	45	14	73	34	68	270	54	324	10	16
27	34	13	45	14	41	22	49	109	54	216	10	16
28	54	14	45	27	239	49	76	81	54	216	10	16
29	40	27	44	25		49	216	63	54	216	14	16
30	25	14	44	27		49	146	68	54	216	16	25
31	18		44	54		97		68		216	16	
	1,622	819	864	719	1,111	3,360	1,714	2,999	2,820	4,092	979	998

YEARLY TOTAL - 22,097 TONS

Figure A134. Example of sediment data for station below Milford Dam, Kansas (Source: Suspended Sediment in the Missouri River, Daily Record for Water Years 1965-1969, U. S. Army Engineer District, Omaha, Omaha, Nebraska, May 1972)

KANSAS RIVER BASIN

6-8571. Republican River below Milford Dam, Kans.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	562	631	870	1.610	1.020	5.640	1.960	1.970	2.600	973	3.970	604
2	560	740	680	1.640	1.020	5.620	1.960	1.960	3.610	970	3.410	1.250
3	556	905	623	1.650	1.020	5.600	1.960	1.520	4.790	970	1.990	2.900
4	621	685	622	1.650	1.020	5.550	1.970	609	823	970	1.330	2.350
5	896	821	617	1.660	1.020	5.520	1.960	585	1.400	970	679	1.270
6	898	905	624	1.660	1.020	5.500	1.950	570	3.610	985	645	1.030
7	665	712	644	1.640	1.020	5.460	1.610	560	3.660	1.010	631	1.030
8	662	667	860	1.630	1.010	5.400	1.050	548	3.650	995	576	1.020
9	670	660	724	1.390	1.010	5.370	594	892	2.350	969	618	1.020
10	664	890	837	681	1.330	5.020	182	1.620	1.010	964	611	1.020
11	671	781	824	384	2.140	4.120	152	1.630	967	1.250	610	1.020
12	672	739	715	357	2.140	3.880	362	1.610	952	1.990	606	888
13	917	670	1.080	339	2.120	3.860	494	1.620	946	2.020	600	547
14	662	723	918	310	2.110	3.860	480	1.610	946	2.000	600	533
15	638	750	1.070	245	2.090	3.850	665	1.600	946	1.990	505	453
16	948	884	993	206	1.630	3.830	1.030	1.610	659	1.290	390	399
17	935	884	1.060	370	1.010	3.700	1.020	1.590	416	633	388	392
18	811	655	1.080	569	829	2.730	994	1.590	396	593	388	379
19	703	639	1.070	570	631	867	988	1.600	687	575	385	376
20	926	607	1.070	568	630	178	983	1.110	935	1.760	403	376
21	715	608	1.070	565	621	481	982	585	992	3.990	467	373
22	702	617	1.060	560	618	1.000	982	1.020	1.040	3.990	428	372
23	689	672	1.050	555	615	1.010	1.690	3.500	971	3.970	416	372
24	746	877	1.320	548	615	1.540	2.840	5.170	968	4.020	410	368
25	608	600	1.610	550	1.080	2.590	2.860	5.110	970	3.980	404	367
26	652	540	1.610	556	1.620	1.190	2.440	4.190	974	4.000	400	359
27	916	565	1.610	555	2.920	1.560	1.250	1.690	970	3.930	400	362
28	680	863	1.610	782	5.740	1.950	1.300	1.990	970	3.940	464	355
29	722	574	1.620	1.030	------	1.940	1.970	2.660	970	3.960	620	452
30	675	617	1.610	1.030	------	1.950	1.980	2.660	965	3.950	614	816
31	677	------	1.630	1.030	------	1.960	------	2.610	------	3.980	610	------
TOTAL	22.419	21.481	32.781	26.890	39.649	102.726	40.658	57.589	45.143	67.587	24.568	23.053
MEAN	723	716	1.057	867	1.416	3.314	1.355	1.858	1.505	2.180	793	768
MAX	948	905	1.630	1.660	5.740	5.640	2.860	5.170	4.790	4.020	3.970	2.900
MIN	556	540	617	206	615	178	152	548	396	575	385	355
AC-FT	44.470	42.610	65.020	53.340	78.640	203.800	80.640	114.200	89.540	134.100	48.730	45.720

CAL YR 1968 TOTAL 222.471 MEAN 608 MAX 1.830 MIN 33 AC-FT 441.300
WTR YR 1969 TOTAL 504.544 MEAN 1.382 MAX 5.740 MIN 152 AC-FT 1.001.000

Figure A135. Example of discharge data for station below Milford Dam, Kansas (Source: Water Resources Data for Kansas, 1969, USGS, Lawrence, Kansas)

Rock River at Joslin, Illinois

Station identification

OWDC No.: 84370

Agency station No.: 05445400

Latitude/longitude: 413335/901055

Agency reporting to OWDC: USGS

River mile: 27.0 (Mile 0 is at the confluence of the Rock and Mississippi rivers; established by the CE about 1935.)

Site description

The sediment and stream gaging stations are on the Illinois State Highway 92 Bridge that crosses the Rock River, 1.8 miles east of Joslin (Figure A136). There are a number of minor tributaries (including Rock Creek) entering the Rock River within 12 miles of these stations. Both banks are unprotected in this reach, and agriculture is the mainstay of this region of Illinois. The streambed material consists of fine gravel and sands, and this reach is not navigable for commercial traffic. Approximate channel gradient is 0.8 ft/mile. The discharges for the period of record (October 1939 to the present) are: maximum - 46,200 cfs; mean - 5,852 cfs; and minimum - 834 cfs. Some diurnal fluctuations are caused by power plants upstream. The sediment loads of record (May 1975 to the present) range from 438 to 8,840 tons/day.

Station chronological record

In November 1974, a station was established by the USGS at this location to collect chemical data as part of the National Stream Quality Accounting Network (NASQUAN). This station monitors drainage from the NASQUAN hydrologic unit 070900. The USGS began its sediment sampling program in May 1975. Sediment sample collection, data reduction, and data publication are the responsibility of the USGS Illinois District. Samples are analyzed at the USGS Sediment Laboratory at Iowa City, Iowa.

Sample and data collection procedures

Information regarding the collection of samples is identical to

that presented for the Illinois River sediment sample collection station at Valley City, Illinois.

The gaging station at Joslin was established on 18 February 1937 by the CE Rock Island District (RID) as a temporary station on the Rock River; it was closed on 30 July 1937. On 19 September 1939, gaging measurements at Joslin were resumed by both the USGS and the U. S. Weather Bureau (now National Weather Service). The following tabulation summarizes the gaging and recording devices used at Joslin as well as their periods of records and the agencies responsible for making these measurements:

Period	Device Used
	RID
18 February 1937 - 30 July 1937	Wire-weight gage
	U. S. Weather Bureau (now National Weather Service)
19 September 1939 - present	Canfield wire-weight gage
	USGS
19 September 1939 - present	Vertical enameled staff gage (two-section)
19 September 1939 - 6 April 1940	Canfield wire-weight gage (Weather Bureau property)
6 April 1940 - 1 October 1964	Stevens continuous graphical recorder
1 October 1964 - present	Fisher-Porter automatic digital recorder (driven by manometer)

Ten discharge measurements per year are furnished by the RID on a cooperative basis; the remainder of the discharge data are collected by the USGS.

Laboratory sample analysis

Information is identical to that presented for the Illinois River

sediment sample collection station at Valley City, Illinois.

Data reduction procedures

Information is identical to that presented for the Illinois River sediment sample collection station at Valley City, Illinois.

Data reporting procedures

Information is identical to that presented for the Illinois River sediment sample collection station at Valley City, Illinois, except that Figure A137 is an example of the water-quality and sediment data for this station.

General information

Although the number of samples collected at this station since May 1975 are not sufficient to draw any reasonable conclusions about sediment loads in this reach of the Rock River, this station is part of the nationwide NASQUAN network and will continue to operate indefinitely. The NASQUAN program is committed to fulfilling the long-term objectives of detection of trends in water quality.

Additional information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, P. O. Box 1026, Champaign, Illinois 61820.

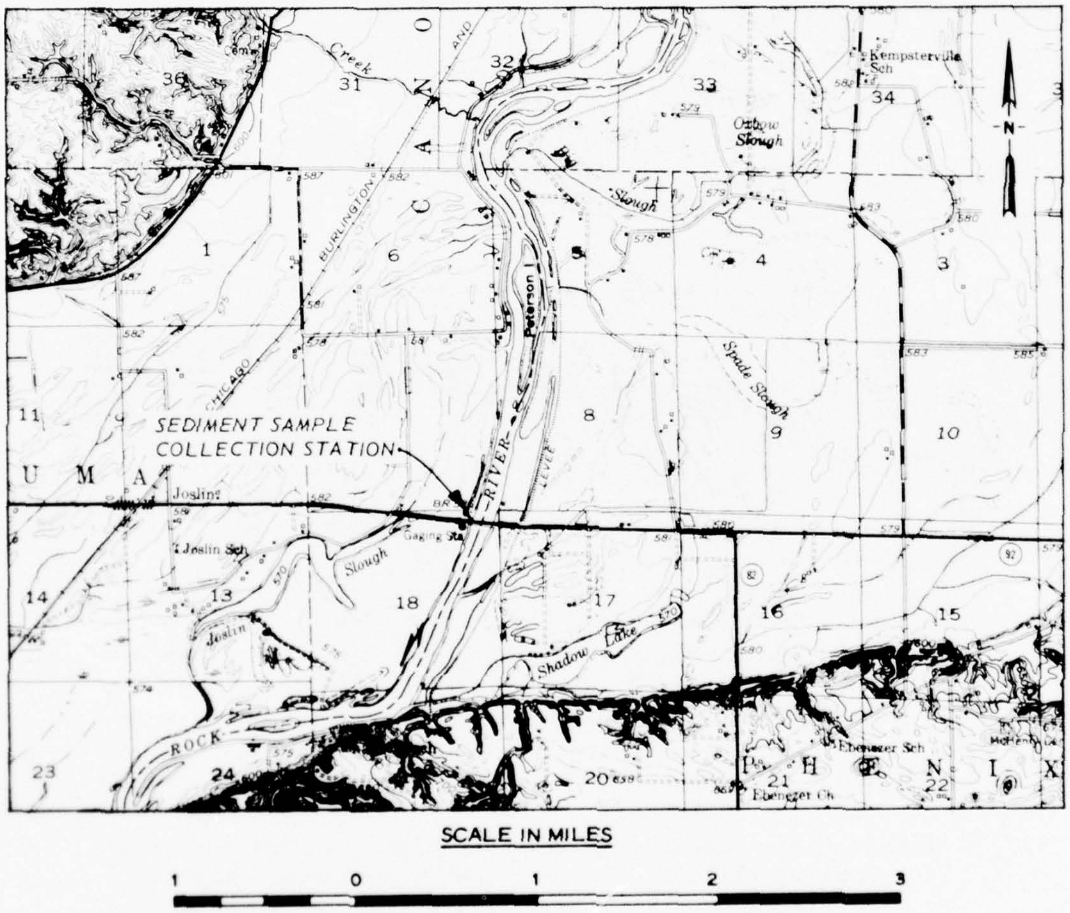

Figure A136. Site location for Joslin, Illinois, sediment sample collection station (Source: USGS Quadrangle Map for Erie, Illinois, 1952)

ROCK RIVER BASIN

05446500 ROCK RIVER NEAR JOSLIN, ILL.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DATE	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	TURBIDITY (JTU)	DISSOLVED OXYGEN (MG/L)	TOTAL PHYTOPLANKTON (CELLS PER ML)	FECAL COLIFORM (COL. PER 100 ML)	STREPTOCOCCI (COLONIES PER 100 ML)	SUSPENDED SEDIMENT (MG/L)	SUSPENDED SEDIMENT DISCHARGE (T/DAY)
NOV.										
13...	786	7.7	12.0	20	--	--	730	980	--	--
DEC.										
12...	646	7.4	2.0	8	--	--	8120	220	--	--
JAN.										
08...	619	8.2	1.5	5	--	--	8240	880	--	--
FEB.										
12...	761	8.3	.5	9	--	--	60	60	--	--
MAR.										
13...	664	7.4	3.0	10	--	--	840	120	--	--
APR.										
15...	525	8.0	9.0	20	--	7300	280	75	--	--
MAY										
08...	580	8.1	14.5	40	--	38000	150	100	186	8840
JUNE										
11...	648	8.1	21.5	50	--	11000	140	570	145	2660
JULY										
09...	598	7.7	26.0	46	--	10000	340	360	167	3620
AUG.										
05...	485	8.2	26.5	7	10.6	150000	230	1500	43	438
SEP.										
04...	624	7.7	23.0	28	8.7	7100	250	180	109	1570

Figure A137. Example of water-quality and sediment data for Joslin, Illinois (Source: Water Resources Data for Illinois, 1975, USGS, Champaign, Illinois)

Root River near Houston, Minnesota

Station identification

OWDE No.: 63308

Agency station No.: 0538500

Latitude/longitude: 434605/913511

Agency reporting to OWDC: USGS

River mile: 17.7 (Mile 0 is at the confluence of the Root and Missisippi rivers; established by the CE about 1945, by scaling from topographic maps.)

Site description

This station is 0.8 mile upstream from the Minnesota State Highway 76 Bridge that crosses the Root River at Houston, Minnesota (Figure A138). Samples are taken from the downstream side of an older highway bridge. Limited agriculture is practiced within the narrow (average width 1 mile) alluvial valley of the Root River. Outside the valley the land rises sharply and is heavily wooded. The streambed material is sand, and when dredging takes place, the concentration of fine sands in the sediment samples increases. An artificial levee parallels the right bank in the vicinity of Houston. The channel gradient is approximately 2.8 ft/mile, and the stream is not navigable for commercial traffic. The discharges of record (May 1909 to September 1917, May to November 1929, and March 1930 to the present) are: maximum - 37,000 cfs; mean - 664 cfs; and minimum - 65 cfs. The discharge passing the station is affected only slightly by diurnal fluctuation at low flows caused by power plants upstream. The sediment loads of record (1968 to the present) are: maximum - 59,600 tons/day; and minimum - 90 tons/day. A mean suspended-sediment load value has not been computed since most of the sediment data collected during the period of record represents days of high flows.

Station chronological record

This station, a long-term surface water station, was established

as a sediment sample collection station by the USGS in 1968. Suspended-sediment samples have been taken on an intermittent and flood-event basis.

In September 1975, the station was converted to a daily sediment sample collection station under the Great I River Study, Sediment and Erosion program (an interagency effort). The purpose of the study is to monitor rates of sedimentation and erosion within the river corridor. The USGS Minnesota District is responsible for sample collection, data reduction, and data publication. The USGS Sedimentation Laboratory in Iowa City, Iowa, analyzes the sediment samples.

Sample and data collection procedures

Information regarding the collection of sediment samples is identical to that presented for the Mississippi River sediment sample collection station at Winona, Minnesota.

The Mississippi River Commission established a gaging station at mile 16.2 on 28 May 1909, and gaging operations continued until 30 September 1917; probably a staff gage was used. On 3 May 1929, the USGS assumed responsibility for the collection of gage-height data at Houston and moved the station to its present position (mile 17.7). The tabulation below presents the gaging and recording devices used from 3 May 1929 to the present by the USGS:

Period	Device Used
3 May 1929 - 27 September 1933	Chain gage
28 September 1933 - present	Au-Fuzee continuous water-stage recorder driven by float in concrete still well until 1965, and since that date, a Stevens A-35 recorder driven by a Servo manometer
15 September 1972 - present	Fisher-Porter automatic digital recorder

Laboratory sample analysis

Information is identical to that presented for the Mississippi River sediment sample collection station at Winona, Minnesota.

Data reduction procedures

Information is identical to that presented for the Mississippi River sediment sample collection station at Winona, Minnesota.

Data reporting procedures

Sediment and discharge data are reported by the Basic Data Section, Water Resources Division, U. S. Geological Survey, St. Paul, Minnesota, and are published in Reference 37. A sample of these data is shown as Figure A139. Beginning with the present water year (1976), separate headings will be provided for suspended-sediment load, bed load, and total sediment discharge on a daily basis. In addition, the data are placed in an automated information storage and retrieval program operated by the USGS, WATSTORE, and in the Environmental Protection Agency's STORET System. Discharge data for this station are also published in Reference 35.

General information

Information on this station can be obtained from: U. S. Department of the Interior, Geological Survey, Water Resources Division, Basic Data Section, Room 1033, Post Office Building, St. Paul, Minnesota 55101.

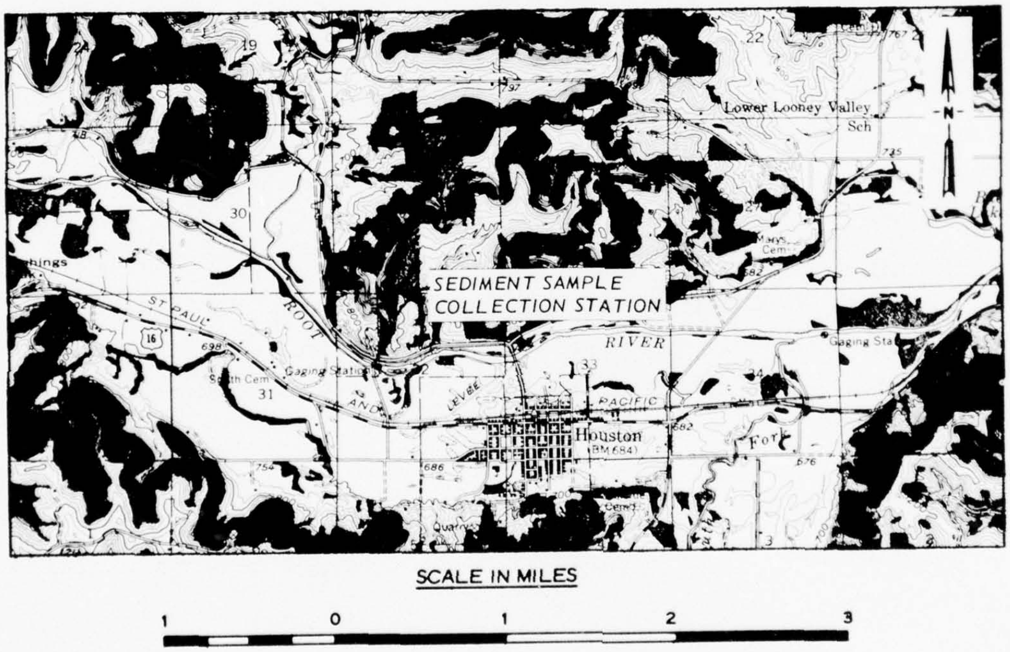

Figure A138. Site location for Houston, Minnesota, sediment sample collection station (Source: USGS Quadrangle Map for Houston, Minnesota, 1958)

05385000 ROOT RIVER NEAR HOUSTON, MINN.

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	4060	1370	16800	820	112	248	1060	126	361
2	2150	555	3220	820	110	244	1010	126	344
3	1590	345	1480	805	122	265	988	116	309
4	1850	728	4090	775	--	--	982	100	265
5	4160	1150	12900	780	--	--	960	82	213
6	2890	620	4840	745	--	--	880	--	--
7	1850	280	1400	765	--	--	810	--	--
8	1570	234	992	745	78	157	790	--	--
9	1420	235	901	750	--	--	840	--	--
10	1330	198	711	730	--	--	820	--	--
11	1260	138	469	745	--	--	725	--	--
12	1390	203	762	775	43	90	810	--	--
13	2100	390	2210	770	--	--	820	--	--
14	1650	262	1170	770	--	--	820	--	--
15	1330	182	654	863	--	--	810	--	--
16	1180	156	497	924	338	843	775	--	--
17	1090	138	406	1230	390	1300	800	--	--
18	1030	125	348	1130	348	1060	800	--	--
19	988	111	296	1000	182	491	800	--	--
20	958	90	233	964	128	333	800	--	--
21	929	75	188	1090	156	459	810	--	--
22	918	75	186	3610	716	7240	820	--	--
23	907	84	206	2450	343	2360	830	--	--
24	891	77	185	1710	169	780	840	--	--
25	874	75	177	1480	158	631	840	--	--
26	858	71	164	1390	166	623	840	--	--
27	845	58	132	1330	180	646	840	--	--
28	855	71	164	1270	177	607	830	--	--
29	835	64	144	1250	155	523	820	--	--
30	845	59	135	1150	128	397	810	--	--
31	820	98	217	--	--	--	800	--	--

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	790	--	--	670	--	--	670	--	--
2	780	--	--	700	--	--	670	--	--
3	770	--	--	700	--	--	1090	1200	3530
4	760	--	--	695	--	--	3420	1740	16100
5	750	--	--	680	--	--	3460	1560	14600
6	740	--	--	680	--	--	4050	1430	15600
7	730	--	--	680	--	--	5950	1580	25400
8	720	--	--	680	--	--	5040	1340	18200
9	710	--	--	675	--	--	3450	908	8460
10	700	--	--	675	--	--	3040	597	4900
11	690	--	--	675	--	--	2720	450	3300
12	680	--	--	675	--	--	2230	360	2170
13	670	--	--	675	--	--	1980	335	1790
14	670	--	--	675	--	--	2100	413	2340
15	670	--	--	675	--	--	1880	301	1530
16	665	116	208	675	--	--	1650	242	1080
17	665	--	--	675	--	--	1500	260	1050
18	665	--	--	675	--	--	1390	243	912
19	670	--	--	675	115	210	1320	194	691
20	680	--	--	675	--	--	1260	176	599
21	680	--	--	675	--	--	1190	150	482
22	680	--	--	675	--	--	1140	125	385
23	685	--	--	675	--	--	1060	160	458
24	690	--	--	670	--	--	946	162	414
25	690	--	--	670	--	--	929	154	386
26	695	--	--	680	--	--	1020	167	460
27	700	--	--	700	--	--	1000	131	354
28	700	--	--	695	--	--	1320	385	1540
29	700	--	--	--	--	--	1830	880	4350
30	700	--	--	--	--	--	2170	859	5030
31	700	--	--	--	--	--	1830	623	3080

Figure A139. Example of sediment data for Houston, Minnesota (Source: Water Resources Data for Minnesota, 1974, USGS, St. Paul, Minnesota) (sheet 1 of 2)

05385000 ROOT RIVER NEAR HOUSTON, MINN.--Continued

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1973 TO SEPTEMBER 1974

DAY	APRIL MEAN DISCHARGE (CFS)	APRIL MEAN CONCEN-TRATION (MG/L)	APRIL SEDIMENT DISCHARGE (TONS/DAY)	MAY MEAN DISCHARGE (CFS)	MAY MEAN CONCEN-TRATION (MG/L)	MAY SEDIMENT DISCHARGE (TONS/DAY)	JUNE MEAN DISCHARGE (CFS)	JUNE MEAN CONCEN-TRATION (MG/L)	JUNE SEDIMENT DISCHARGE (TONS/DAY)
1	2770	1070	8000	1040	114	320	1130	113	345
2	3360	1120	10200	1020	98	270	1070	107	309
3	3380	1070	9760	1030	83	231	1110	112	336
4	7140	3000	59600	1010	97	265	1140	121	372
5	8090	2450	54100	990	120	321	1390	343	1430
6	3720	1120	11200	962	120	312	1440	415	1610
7	2920	819	6460	962	104	270	1300	245	860
8	2530	559	3820	1060	89	255	1300	205	720
9	2260	355	2170	1060	120	343	2000	902	5700
10	2030	278	1520	1030	148	412	5420	3000	43900
11	1890	301	1540	1170	326	1030	5210	1360	19100
12	1820	273	1340	1410	371	1410	3070	760	6300
13	1890	241	1230	1480	288	1150	2410	440	2860
14	2470	463	3090	1550	235	983	2070	325	1820
15	2190	513	3030	2150	428	2480	1860	320	1610
16	2000	360	1940	1980	537	2870	1700	320	[1]1470
17	1690	386	1760	1670	394	1780	1600	200	864
18	1550	449	1880	1480	294	1170	1500	170	689
19	1440	437	1700	1390	235	882	1540	210	873
20	1390	396	1490	1350	212	773	1800	1110	5390
21	1390	246	923	1390	266	998	11000	4050	135000
22	1390	204	766	1850	805	4020	14900	2460	108000
23	1370	194	718	2250	1820	11100	4370	1640	19400
24	1300	187	656	1700	1100	5050	2960	712	5690
25	1230	181	601	1460	487	1920	2310	461	2880
26	1210	153	500	1340	301	1090	1990	399	2140
27	1190	142	456	1310	231	817	1810	370	1810
28	1190	143	459	1260	198	674	1660	328	1470
29	1150	137	425	1240	179	599	1560	268	1130
30	1100	127	377	1180	164	523	1470	291	1150
31	--	--	--	1160	141	442	--	--	--

DAY	JULY MEAN DISCHARGE (CFS)	JULY MEAN CONCEN-TRATION (MG/L)	JULY SEDIMENT DISCHARGE (TONS/DAY)	AUGUST MEAN DISCHARGE (CFS)	AUGUST MEAN CONCEN-TRATION (MG/L)	AUGUST SEDIMENT DISCHARGE (TONS/DAY)	SEPTEMBER MEAN DISCHARGE (CFS)	SEPTEMBER MEAN CONCEN-TRATION (MG/L)	SEPTEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	1400	280	1060	810	--	--	650	--	--
2	1340	246	890	836	158	357	640	--	--
3	1280	223	771	847	--	--	630	--	--
4	1230	221	734	820	368	815	617	--	--
5	1200	224	726	800	--	--	611	--	--
6	1170	246	777	785	--	--	608	--	--
7	1140	269	828	760	--	--	621	--	--
8	1110	294	881	750	--	--	610	--	--
9	1060	294	841	745	--	--	627	--	--
10	1050	243	689	765	--	--	619	--	--
11	1100	171	508	805	172	370	616	--	--
12	1040	168	472	775	--	--	631	--	--
13	1010	156	431	760	--	--	641	--	--
14	988	155	413	745	96	193	630	--	--
15	952	150	386	725	--	--	615	--	--
16	929	146	366	720	--	--	608	--	--
17	913	143	353	715	--	--	601	--	--
18	902	138	336	710	--	--	587	70	111
19	896	131	317	715	--	--	587	--	--
20	885	145	346	715	--	--	580	--	--
21	869	194	455	924	--	--	570	--	--
22	940	226	574	1350	1670	6090	564	--	--
23	924	228	569	913	--	--	565	--	--
24	869	213	500	790	--	--	585	--	--
25	863	204	475	750	--	--	579	--	--
26	874	214	505	730	--	--	575	--	--
27	869	223	523	715	--	--	578	--	--
28	852	215	495	690	--	--	617	--	--
29	842	200	455	675	--	--	659	--	--
30	825	--	--	665	--	--	613	--	--
31	820	--	--	660	--	--	--	--	--

Figure A139 (sheet 2 of 2)

Saline River at Tescott, Kansas

Station identification

OWDC No.: 50240

Agency station No.: 06869500

Latitude/longitude: 390015/975226

Agency reporting to OWDC: USGS

River mile: 68.5 (Mile 0 is at the confluence of the Saline and Smoky Hill rivers; established by the CE in 1969.)

Site description

The sediment sample collection and stream-gaging stations are on an Ottawa County Highway Bridge that crosses the nonnavigable (for commercial traffic) Saline River, 0.5 mile south of Tescott, Kansas (Figure A140). The streambanks are unprotected, and the streambed material consists of clay with some fine sand. The channel gradient through this reach is 2.0 ft/mile. Upstream from the station the land is primarily used for agriculture, and annual soil loss due to erosion is 500-1,000 tons/square mile. Flow is regulated by Wilson Dam (storage began 29 December 1964). Flow is also affected by upstream diversions for irrigation and by power plants, which cause diurnal fluctuations. The discharges of record prior to closure of Wilson Dam (1919-29 December 1964) are: maximum - 61,400 cfs; mean - 236 cfs; and minimum - 0 cfs. The discharges of record after closure of Wilson Dam 29 December 1964 to the present) are: maximum - 9,120 cfs; mean - 47 cfs; and minimum - 32 cfs. The sediment loads of record prior to closure of Wilson Dam (October 1959 to 29 December 1964) are: maximum - 69,000 tons/day; mean - 2,058 tons/day; and minimum - 1.0 ton/day. The sediment loads of record after closure of Wilson Dam (29 December 1964 to the present) are: maximum - 34,000 tons/day; mean - 167 tons/day; and minimum - 0.21 ton/day.

Station chronological record

The sediment station was established by the USGS Kansas District in October 1959 to determine the sediment contribution of the Saline

River to the Smoky Hill River. The USGS Kansas District is responsible for collecting and analyzing the samples as well as for reducing and reporting the resulting data.

Sample and data
collection procedures

From October 1959 to 1 October 1970, samples were taken on a daily basis following the daily procedures discussed for the Kansas River sediment sample collection station at Wamego, Kansas, prior to 1 October 1975. From 1 October 1970 to the present, samples have been collected monthly following the USGS monthly sample collection procedures discussed for the Wamego, Kansas.

Prior to establishment of a gaging station in Tescott, the USGS maintained stations from 1895 to 1897 with nonrecording gages at Beverly (river mile approximately 75) and near Salina (river mile approximately 75). The USGS began gaging operation at Tescott (mile 68.5) on 3 September 1919. The gaging and recording devices used by this agency at Tescott during the period of record are tabulated below:

Period	Device Used
3 September 1919 - 9 February 1939	Chain-and-weight gage (short box type)
23 November 1934 - present	Stevens A-35 continuous water-stage recorder (driven by manometer since 1963)
10 February 1939 - present	Type A wire-weight gage
1963 - present	Fisher-Porter automatic digital recorder, Model 1542 (driven by manometer)

Laboratory sample analysis

Information is identical to that presented for the Kansas River sediment sample collection station at Wamego, Kansas.

Data reduction procedures

Information is identical to that presented for the Kansas River sediment sample collection station at Wamego, Kansas.

Data reporting procedures

Suspended-sediment loads were published for the period of October 1959 through 1960 in Reference 16 and from 1961 to the present in Reference 22. Since October 1970, only the monthly values have been reported. Figure A141 shows an example of the data reported for this station. These data are included in the Environmental Protection Agency's STORET System.

General information

Sediment and discharge records for this station are considered good. Additional information on this station can be obtained from: District Chief, Water Resources Division, U. S. Geological Survey, 1950 Avenue A-Campus West, University of Kansas, Lawrence, Kansas 66045.

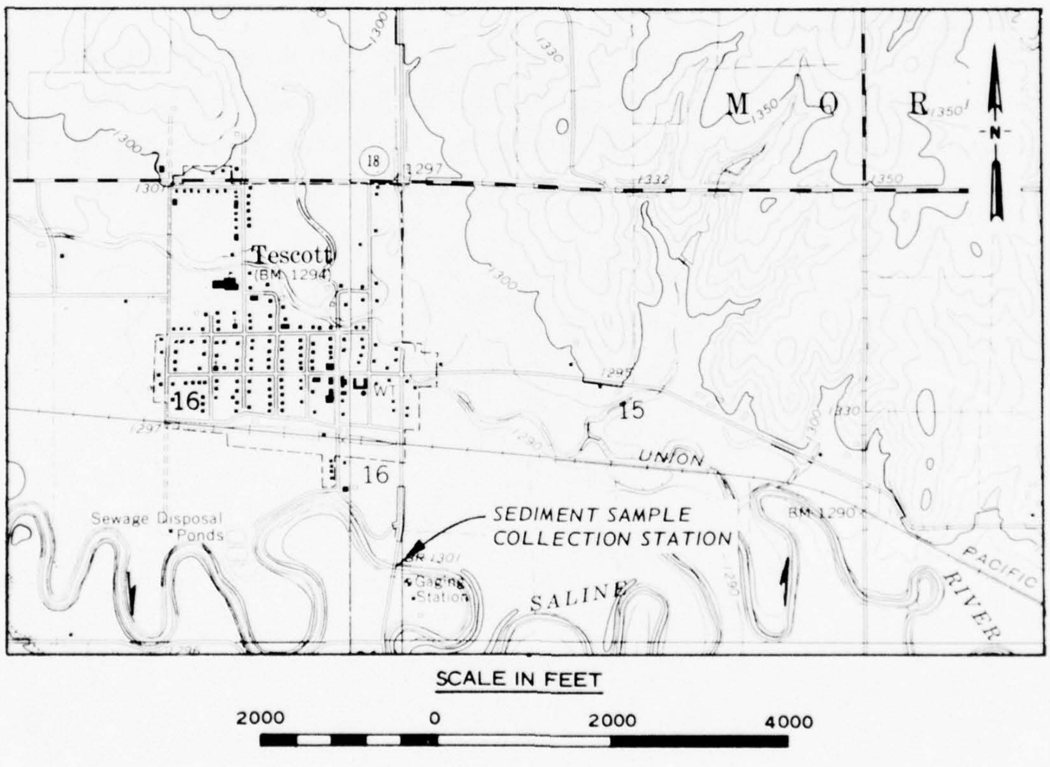

Figure A140. Site location for Tescott, Kansas, sediment sample collection station (Source; USGS Quadrangle Map for Tescott SE, Kansas, 1965)

KANSAS RIVER BASIN

06869500 SALINE RIVER AT TESCOTT, KS.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DATE	TIME	INSTAN-TANEOUS DIS-CHARGE (CFS)	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)
OCT.				
08...	1130	53	150	21
NOV.				
06...	1030	67	46	8.3
DEC.				
03...	1045	45	15	1.8
JAN.				
09...	1130	62	24	4.0
FEB.				
21...	1140	66	15	2.7
MAR.				
27...	1100	66	92	16
APR.				
28...	1120	68	157	29
MAY				
16...	1045	69	447	83
JUNE				
11...	1245	329	747	664
25...	1345	1070	2890	8350
JULY				
18...	1145	739	414	826
AUG.				
08...	1130	46	1910	237
SEP.				
12...	1225	60	339	55

Figure A141. Example of data for Tescott, Kansas (Source: Water Resources Data for Kansas, 1975, USGS, Lawrence, Kansas)

Saline River Below Wilson Dam, Kansas

Station identification

OWDC No.: 54683

Agency station No.: 229-1

Latitude/longitude: 385800/982935

Agency reporting to OWDC: CE

River mile: 153.9 (Mile 0 is at the confluence of the Saline and Smoky Hill rivers; established by the CE in 1969.)

Site description

The sediment sample collection station was at the end of the outlet tunnel downstream from Wilson Dam (Figure A142). The dam is a rolled-earth-fill embankment 5,600 ft long and reaches 160 ft above the streambed; it is 10 miles north of Wilson, Kansas. Storage in the reservoir began 29 December 1964. Riprap and concrete have been placed on the streambanks at the outlet tunnel. The stream gradient in the vicinity of the site is 2.0 ft/mile, and the bed material is sandy. Annual soil loss due to erosion upstream from the site is 500-1,000 tons/square mile. There is no agriculture or industry in the immediate vicinity; however, there is some agriculture downstream from the site. From May 1929 to September 1963, there was a gaging station (Saline River near Wilson, Kansas) approximately 6.3 miles upstream from the present damsite, but this station was discontinued September 1963. The discharges of record from this station are: maximum - 24,300 cfs; mean - 166 cfs; and minimum - 0.0 cfs. A gaging station (Saline River at Wilson Dam, Kansas) was established (in March 1963) 0.5 mile downstream from the dam from which the discharge records reported below were obtained. The discharges of record prior to closing of the dam (March 1963 - December 1964) are: maximum - 1,840 cfs; mean - 46 cfs; and minimum - 0.50 cfs. The discharges of record after the dam was closed (December 1964 to the present) are: maximum - 3,220 cfs; mean - 56 cfs; and minimum - 0.30 cfs. The sediment loads of record from October 1964 to September 1974 are:

maximum - 399 tons/day; mean - 4.88 tons/day; and mimimum - 0.0 ton/day. The flow is completely regulated by Wilson Dam.

Station chronological record

The sediment sample collection station was established by the CE Kansas City District (KCD) in October 1964 to monitor the sediment passing through the outfall of the dam. Samples were collected by the KCD personnel stationed at the reservoir; data were reduced and reported by the KCD. Agencies responsible for laboratory sample analysis were as follows:

a. The KCD Soils Laboratory (1964 - May 1973).

b. The CE Missouri River Division Soils Laboratory (May 1973 - April 1974).

c. The USGS Soils Laboratory (April 1974 - September 1974).

The station was closed in September 1974.

Sample and data collection procedures

Weekly milk-bottle grab samples were collected at the surface by personnel stationed at the reservoir. Some chemical analyses were run on the sample. At the older gaging station (Saline River near Wilson, Kansas), river stage was measured with a water-gage recorder during the latter part of the period of record and probably with a nonrecording gage during the earlier part of the period of record. Discharges are measured at the (KCD) present gaging station, 0.5 mile downstream from the dam, with a Fisher-Porter automatic digital recorder, Model 1542, and a Stevens A-35 recorder.

Laboratory sample analysis

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Suspended-sediment load data were published in Reference 11. Discharge data were published for years prior to 1961 in Reference 12

and for years since 1961 in Reference 10. Figures A143 and A144 show examples of data published for these stations.

General information

Sediment and discharge records for this station are considered to be good. Additional information on this station can be obtained from U. S. Army Engineer District, Kansas City, Hydrologic Engineering Branch, Water Control Section, 700 Federal Building, 601 East Twelfth St., Kansas City, Missouri 64106.

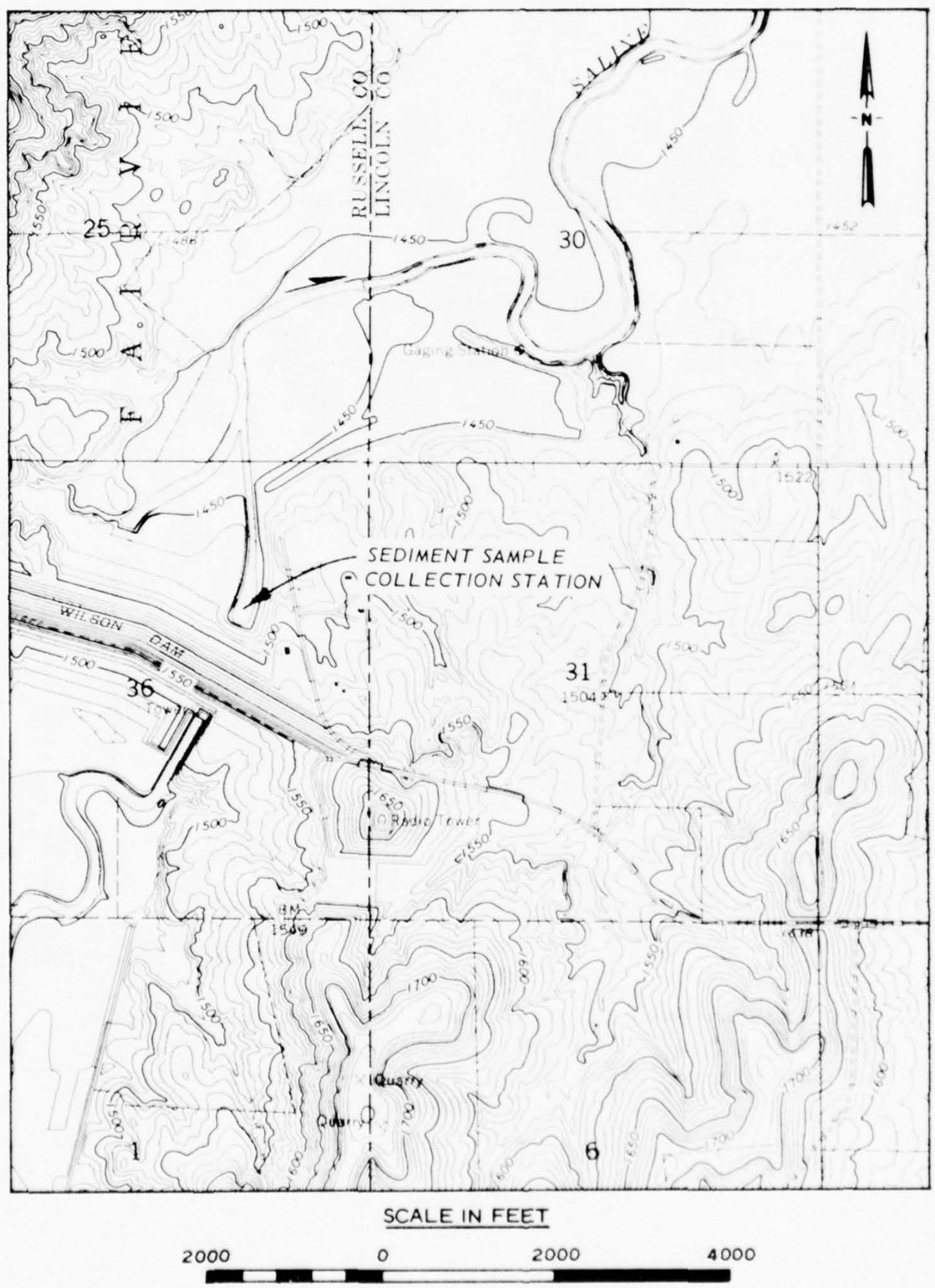

Figure A142. Site location for below Wilson Dam, Kansas, sediment sample collection station (Source: USGS Quadrangle Map for Wilson NW, Kansas, 1964)

SALINE RIVER AT WILSON RESERVOIR, KANSAS

SUSPENDED SEDIMENT LOAD - TONS WATER YEAR OCT 1968 - SEP 1969

	OCT	NOV	DEC	JAN	FER	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2	0	0	0	0	0	0	0	0	1	2	1
2	2	0	1	0	1	0	0	0	0	1	2	1
3	2	0	1	1	1	0	0	0	0	1	2	1
4	2	0	1	0	1	0	0	0	0	0	2	1
5	2	0	1	0	0	0	0	0	0	1	2	1
6	2	0	1	0	0	0	0	0	0	1	2	1
7	2	0	1	0	0	0	0	0	0	0	2	1
8	2	0	1	0	0	0	0	0	0	0	2	1
9	2	0	1	0	0	0	0	0	1	0	3	1
10	1	0	1	41	0	0	0	1	1	0	3	1
11	19	0	1	1	0	5	0	0	1	0	3	1
12	1	0	1	1	0	0	0	0	1	0	2	1
13	1	0	1	1	0	0	0	0	1	0	2	1
14	1	0	1	1	0	0	0	0	0	0	2	1
15	1	0	1	0	1	0	0	0	0	0	1	1
16	1	0	1	0	1	0	0	0	0	0	1	1
17	1	0	1	0	1	0	1	0	0	0	1	1
18	1	0	1	0	0	0	0	0	0	3	1	1
19	1	0	1	0	0	0	1	0	0	3	1	1
20	1	0	1	0	0	0	1	1	0	3	1	1
21	1	0	1	0	0	0	1	1	0	3	1	1
22	1	0	1	0	0	0	1	1	0	3	1	1
23	1	0	1	0	0	0	1	1	0	3	1	1
24	1	0	1	0	0	0	1	1	0	3	1	1
25	1	0	1	0	0	0	1	1	0	2	1	1
26	0	0	1	0	0	0	1	1	0	2	1	1
27	0	0	0	0	0	0	1	1	0	1	1	1
28	0	0	0	0	0	0	1	0	0	1	1	1
29	0	0	0	0		0	1	0	0	1	0	1
30	0	0	0	0		0	1	0	1	1	0	1
31	0		0	0		0		0		1	1	
	52	0	25	46	6	5	13	9	6	35	46	30

YEARLY TOTAL = 273 TONS

Figure A143. Example of sediment data for station below Wilson Dam, Kansas (Source: Suspended Sediment in the Missouri River, 1965-1969, U. S. Army Engineer District, Omaha, Omaha, Nebraska, May 1972)

KANSAS RIVER BASIN

6-8682. Saline River at Wilson Dam, Kans.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1968 TO SEPTEMBER 1969

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	18	7.7	3.8	5.0	5.7	2.1	2.3	2.7	3.0	2.3	17	5.8
2	18	3.7	3.8	5.1	5.7	2.1	2.3	2.3	3.0	2.3	17	5.2
3	18	3.2	3.8	5.4	5.7	2.1	2.2	2.4	3.0	2.3	17	5.2
4	18	3.2	4.1	5.7	5.7	2.1	2.2	2.6	3.0	2.2	17	5.2
5	18	3.3	4.0	5.4	5.7	1.8	2.3	2.6	3.0	3.0	17	5.2
6	18	3.4	4.0	5.4	5.7	1.7	2.3	2.6	3.0	28	16	5.2
7	18	3.4	4.0	5.2	6.0	1.7	2.1	2.6	3.0	2.6	16	5.2
8	18	3.2	4.0	5.5	6.5	2.2	2.2	3.0	3.1	2.4	136	5.2
9	18	3.1	4.0	5.4	6.0	1.6	2.2	80	3.0	2.4	22	5.2
10	108	3.2	71	71	49	199	2.2	5.6	103	113	21	122
11	17	3.0	7.6	7.8	3.2	4.4	108	4.4	4.2	7.5	20	9.7
12	14	71	6.3	7.3	3.0	3.6	2.7	4.0	3.8	6.3	20	8.8
13	14	6.0	6.6	7.0	2.8	3.2	2.6	3.5	3.6	6.2	20	8.4
14	13	5.9	6.4	6.8	2.8	3.0	2.6	2.8	3.6	6.2	20	8.0
15	13	5.3	6.4	7.0	2.8	3.0	2.5	2.9	3.6	6.1	20	7.8
16	21	5.1	6.4	6.4	2.8	3.0	2.8	3.3	3.6	5.9	19	7.8
17	14	4.7	6.4	6.4	2.8	2.8	3.0	3.4	3.8	16	19	7.8
18	13	4.7	6.0	6.4	2.6	2.8	2.7	3.3	3.5	21	19	7.8
19	13	4.4	5.6	6.1	2.6	2.6	2.5	3.2	3.4	20	19	7.5
20	13	4.4	5.4	6.1	2.6	2.3	2.4	3.1	3.0	20	19	7.1
21	12	4.4	5.2	6.1	2.6	2.3	2.2	8.0	9.8	20	19	7.1
22	12	4.4	5.2	6.0	2.6	2.3	2.1	2.2	9.7	19	18	7.1
23	13	4.2	5.2	6.0	2.6	3.0	2.0	2.2	2.8	19	18	7.1
24	13	4.2	5.2	6.2	2.8	3.6	2.2	20	2.8	19	20	7.1
25	12	3.9	5.1	6.4	2.8	2.4	2.2	2.8	2.4	18	27	7.1
26	13	3.9	5.1	6.2	2.6	2.3	3.0	2.6	2.4	18	18	7.1
27	13	4.0	5.0	6.4	2.6	2.4	3.2	2.6	2.3	17	18	6.8
28	12	4.1	5.0	6.4	2.4	2.4	3.1	2.7	2.2	17	13	6.8
29	12	4.2	5.0	6.4	------	2.3	2.9	3.6	2.2	17	5.7	6.8
30	12	4.0	5.0	6.4	------	2.3	2.8	3.0	2.3	17	5.7	6.5
31	12	------	5.0	5.9	------	2.3	------	3.0	------	17	43	------
TOTAL	551	193.2	225.6	254.8	150.7	274.7	179.8	193.0	205.1	473.7	696.4	319.6
MEAN	17.8	6.44	7.28	8.22	5.38	8.86	5.99	6.23	6.84	15.3	22.5	10.7
MAX	108	71	71	71	49	199	108	80	103	113	136	122
MIN	12	3.0	3.8	5.0	2.4	1.6	2.0	2.2	2.2	2.2	5.7	5.2
AC-FT	1,090	383	447	505	299	545	357	383	407	940	1,380	634

CAL YR 1968 TOTAL 35,330.8 MEAN 96.5 MAX 228 MIN 1.1 AC-FT 70,080
WTR YR 1969 TOTAL 3,717.6 MEAN 10.2 MAX 199 MIN 1.6 AC-FT 7,370

Figure A144. Example of discharge data for Wilson Dam, Kansas (Source: Water Resources Data for Kansas, 1969, USGS, Lawrence, Kansas)

Skunk River at Augusta, Iowa

Station identification

OWDC No.: Number to be assigned

Agency station No.: 0547400

Latitude/longitude: 404513/911640

Agency reporting to OWDC: USGS

River mile: 12.5 (Mile 0 is at the confluence of the Skunk and Mississippi rivers; established by the CE in about 1935.)

Site description

The sediment sample collection station is on the Iowa State Highway 394 Bridge (Figure A145). The present official gaging station is on the left bank of the river 300 ft upstream from the sediment station. The streambanks in this reach are unprotected, heavily wooded, and subject to overtopping; a steep bluff lies 0.5 mile from the right bank. Above the bluff are some summer cottages. Augusta, as well as wooded and agricultural areas, are on the left bank. There is no commercial traffic in this stream. The streambed material consists of sands and silts, and the channel gradient is approximately 1.9 ft/mile. Discharges measured during the period of record (September to 15 November 1913, and October 1914 to the present) are: maximum - 66,800 cfs; mean - 2,352 cfs; and minimum - 7 cfs. Sediment samples have been taken only since October 1975; thus, no estimates of sediment load are available.

Station chronological record

This station was established in October 1975 near the mouth of the Skunk River at a long-term stream gaging station. Although the USGS had previously collected periodic samples from the northern (upper) reaches of the river, sediment data were lacking from this reach. The station was also established to monitor the sediment contribution of the Skunk River to the Mississippi River. Sample collection, sample laboratory analysis, data reduction, and data publication are the responsibility of the USGS Iowa District, Iowa City, Iowa.

Sample and data
collection procedures

A single depth-integrated sample is collected daily by a paid observer using a US D-49 sampler. During periods of high flow, the sampling frequency is increased. During periods of low flow, a US DH-59 hand-held sampler is used. Water temperature is measured with each sample. Periodically, equal-transit-rate (ETR) samples are also taken; the sediment load calculated by the ETR method is used to derive a correction factor for estimating the load from the single depth-integrated sample taken by the observer. Periodic bed-material samples are taken with a US BM-54 sampler. The use of these samplers and the ETR method are explained in Reference 1a.

Gaging in the vicinity of Augusta began in September 1913 and was discontinued in November of 1913. It was resumed on 27 May 1915. The present gaging station is operated as a cooperative venture between the USGS and the Iowa Institute of Hydraulic Research. The following tabulation lists the gaging and recording devices used in the vicinity of Augusta and the agencies responsible for gathering these data:

Period	Locality	Device Used
	Hydraulic Engineering Company of Maine	
September - 15 November 1913	Old Highway Bridge, 400 ft upstream from present gage house (mile 12.5)	Staff gage
	USGS	
27 May 1915 - 14 January 1935	Old Highway Bridge, 400 ft upstream from present gage house (mile 12.5)	Chain gage
1935 - present	State Highway 394 Bridge (mile 12.5)	Staff gage
1935 - present	State Highway 394 Bridge (mile 12.5)	Canfield wire-weight gage, replaced by a Type A wire-weight gage

(Continued)

Period	Locality	Device Used
	USGS (Continued)	
15 January 1935 - present	300 ft upstream from State Highway 394 Bridge (mile 12.5)	Stevens A-35 recorder driven by float
26 October 1965 - present	300 ft upstream from State Highway 394 Bridge (mile 12.5)	Fisher-Porter automatic digital recorder driven by chain from Stevens recorder

The stage-discharge relation at Augusta is affected by ice during extremely cold weather. The daily discharge is computed by using the rating curve developed for the present gaging station. Several discharge measurements are furnished each year by the CE Rock Island District.

Laboratory sample analysis

Information is identical to that presented for the Cedar River sediment sample collection station at Cedar Rapids, Iowa.

Data reduction procedures

Information is identical to that presented for the Boyer River sediment sample collection station at Logan, Iowa.

Data reporting procedures

No sediment data have ever been published but will appear annually in Reference 14 beginning with the publication of water year 1976 data. (No examples are available.) These as well as daily discharge values will be entered in WATSTORE, an automated information retrieval system operated by the USGS, and will automatically become a part of the Environmental Protection Agency's STORET System. Discharge data were published in Reference 12 prior to 1961 and in Reference 15 since that date.

General information

Although this station has only a short-term sediment record, it will continue to operate as a daily station for an extended period to monitor the sediment contribution of the Skunk River to the Mississippi River.

Additional information on this station can be obtained from:

U. S. Department of the Interior, Geological Survey, Water Resources Division, 400 South Clinton Street, P. O. Box 1230, Iowa City, Iowa 52240.

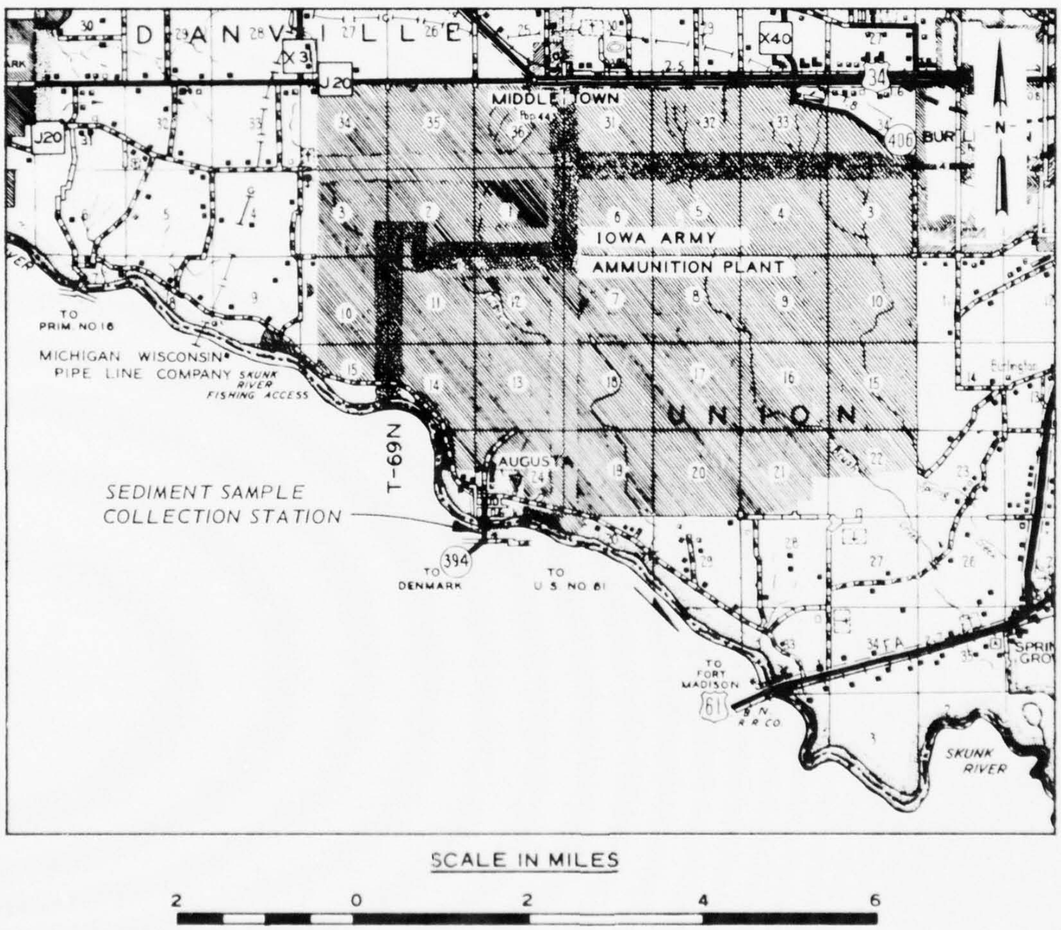

Figure A145. Site location for Augusta, Iowa, sediment sample collection station (Source: Des Moines County, Iowa General Highway and Transportation Map, Iowa Department of Transportation, Ames, Iowa, 1974)

Smoky Hill River at Enterprise, Kansas

Station identification

OWDC No.: 50250

Agency station No.: 06877600

Latitude/longitude: 385424/970712

Agency reporting to OWDC: USGS

River mile: 43.3 (Mile 0 is at the confluence of the Smoky Hill and Republican rivers; established by the CE in 1969.)

Site description

The sediment sample collection and stream gaging stations are on the State Highway 43 Bridge that crosses the nonnavigable (for commercial traffic) Smoky Hill River at Enterprise, Kansas (Figure A146). Upstream from the station, the left bank is protected by a Kellner jetty field. The land in the vicinity of the station is used primarily for agriculture. The streambed material is composed of fine sand and silt, and the channel gradient through this reach is 1.7 ft/mile. Natural flow is affected by dams and by numerous upstream diversions for irrigation. The dams in the closest proximity affecting the flow are: Kanopolis Dam on the Smoky Hill River (storage began 17 February 1948), Wilson Dam on the Saline River (storage began 29 December 1964), and Glen Elder Dam on the Solomon River (storage began 1 January 1969). The discharges of record prior to the closure of Wilson Dam (1934 to 29 December 1964) are: maximum - 233,000 cfs; mean - 1,711 cfs; and minimum - 10 cfs. The discharges of record after the closure of Glen Elder Dam (1 January 1969 to the present) are: maximum - 47,100 cfs; mean - 1,815 cfs; and minimum - 44 cfs. The sediment loads of record prior to the closure of Wilson Dam (October 1955 to 29 December 1964) are: maximum - 254,000 tons/day; mean - 10,399 tons/day; and minimum - 5.0 tons/day. The sediment loads of record after closure of Glen Elder Dam (1 January 1969 to the present) are: maximum - 249,000 tons/day; mean - 5,812 tons/day; and minimum - 4.8 tons/day.

Station chronological record

A water-quality (chemical analysis) station was established by the USGS Kansas District in October 1955. Collection of sediment samples to determine the sediment contribution of the Smoky Hill River and tributaries to the Kansas River began in October 1957. During the period of record, the USGS Kansas District has been responsible for collecting and analyzing the samples as well as for reducing and reporting the resulting data. The station was incorporated into the National Stream Quality Accounting Network program on 1 October 1974.

Sample and data collection procedures

Information regarding the collection of sediment samples is identical to that presented for the Kansas River sediment sample collection station at Wamego, Kansas.

Gaging by the U. S. Weather Bureau (now National Weather Service) and the USGS in the vicinity of Enterprise began on 1 November 1934. The following tabulation summarizes the localities of the gaging and recording devices used cooperatively by these two agencies during the period or record for this station:

Period	Locality	Device Used
1 November 1934 - 29 February 1956	Santa Fe Railway bridge (mile 43.1)	Type A wire-weight gage
1934 - ?	Santa Fe Railway bridge (mile 43.1)	Staff gage
29 January 1935 - 3 May 1959	Santa Fe Railway bridge (mile 43.1)	Friez Type FA3 recorder, replaced by a Stevens A-34 continuous water-stage recorder (both driven by floats)
1 March 1956 -	State Highway 43 Bridge (mile 43.1)	Type A wire-weight gage
4 May 1959 - present	State Highway 43 Bridge (mile 43.3)	Stevens A-35 continuous water-stage recorder (driven by manometer)

Period	Locality	Device Used
1964 - present	State Highway 43 Bridge (mile 43.3)	Fisher-Porter automatic digital recorder, Model 1542 (driven by manometer)

Laboratory sample analysis

Information is identical to that presented for the Kansas River sediment sample collection station at Wamego, Kansas.

Data reduction procedures

Information is identical to that presented for the Kansas River sediment sample collection station at Wamego, Kansas.

Data reporting procedures

Suspended-sediment load data were published from October 1957 through 1960 in Reference 16 and from 1961 to the present in Reference 22. Since September 1975, only monthly values have been published. Figure A147 shows an example of the data reported for this station. Discharge data were published for years prior to 1961 in Reference 12 and from 1961 to the present in Reference 10. These data are included in the Environmental Protection Agency's STORET System.

General information

Sediment and discharge records for this station are considered good. Additional information on this station can be obtained from: District Chief, Water Resources Division, U. S. Geological Survey, 1950 Avenue A-Campus West, University of Kansas, Lawrence, Kansas 66045.

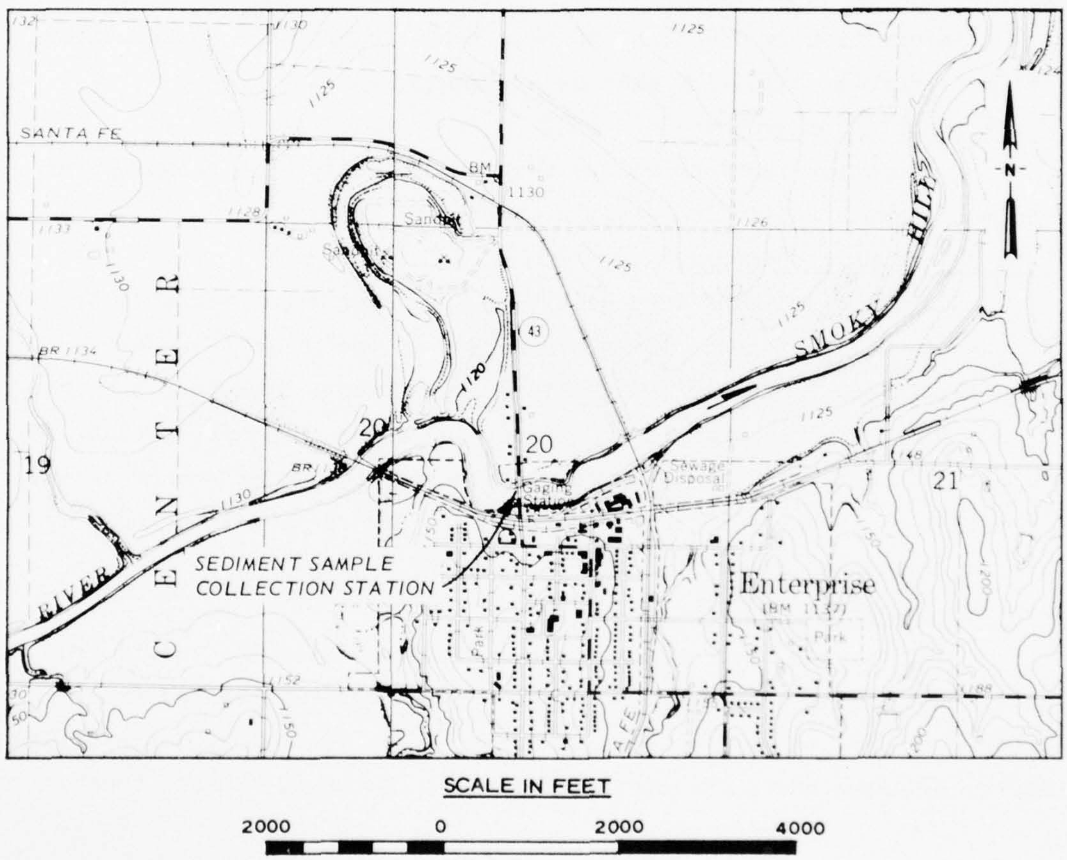

Figure A146. Site location for Enterprise, Kansas, sediment sample collection station (Source: USGS Quadrangle Map, Chapman, Kansas, 1964)

KANSAS RIVER BASIN

06877600 SMOKY HILL RIVER AT ENTERPRISE, KS.

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DAY	OCTOBER MEAN DISCHARGE (CFS)	OCTOBER MEAN CONCEN-TRATION (MG/L)	OCTOBER SEDIMENT DISCHARGE (TONS/DAY)	NOVEMBER MEAN DISCHARGE (CFS)	NOVEMBER MEAN CONCEN-TRATION (MG/L)	NOVEMBER SEDIMENT DISCHARGE (TONS/DAY)	DECEMBER MEAN DISCHARGE (CFS)	DECEMBER MEAN CONCEN-TRATION (MG/L)	DECEMBER SEDIMENT DISCHARGE (TONS/DAY)
1	825	122	272	1500	651	2640	470	59	75
2	820	121	268	1170	429	1360	480	30	39
3	745	111	223	870	302	709	485	25	33
4	569	87	134	1140	487	1500	488	25	33
5	512	74	102	984	226	600	490	25	33
6	515	62	86	805	149	324	495	25	33
7	642	101	175	670	103	186	482	25	33
8	810	152	332	715	100	193	478	25	32
9	770	259	538	800	141	305	475	25	32
10	572	262	405	855	156	360	472	25	32
11	498	176	237	845	131	299	465	22	28
12	554	177	265	710	85	163	462	24	30
13	2380	1810	11600	626	91	154	460	21	26
14	1890	1960	10000	587	55	87	455	27	33
15	1700	1160	5320	569	49	75	445	13	16
16	1230	897	2980	554	44	66	438	13	15
17	825	498	1110	542	85	124	440	24	29
18	646	272	474	536	52	75	435	7	8.2
19	785	219	464	536	56	81	428	16	18
20	900	222	539	533	51	73	425	16	18
21	830	160	359	533	70	101	448	12	15
22	658	137	243	530	58	83	524	27	38
23	590	121	193	530	49	70	533	27	39
24	572	91	141	518	42	59	533	36	52
25	542	86	126	503	46	62	518	22	31
26	536	102	148	490	59	78	498	8	11
27	542	97	142	480	58	75	480	39	51
28	545	73	107	475	62	80	482	6	7.8
29	840	151	342	472	60	76	488	36	47
30	1470	748	2970	468	80	101	488	12	16
31	1640	788	3490	--	--	--	488	10	13
TOTAL	26953	--	43785	20546	--	10159	14748	--	917.0

DAY	JANUARY MEAN DISCHARGE (CFS)	JANUARY MEAN CONCEN-TRATION (MG/L)	JANUARY SEDIMENT DISCHARGE (TONS/DAY)	FEBRUARY MEAN DISCHARGE (CFS)	FEBRUARY MEAN CONCEN-TRATION (MG/L)	FEBRUARY SEDIMENT DISCHARGE (TONS/DAY)	MARCH MEAN DISCHARGE (CFS)	MARCH MEAN CONCEN-TRATION (MG/L)	MARCH SEDIMENT DISCHARGE (TONS/DAY)
1	470	6	7.6	458	10	12	1260	340	1160
2	472	8	10	455	7	8.6	1000	221	597
3	475	10	13	455	11	14	851	62	142
4	455	12	15	530	103	147	822	41	91
5	455	25	31	966	283	738	816	48	106
6	438	32	38	675	101	184	801	51	110
7	460	38	47	521	37	52	797	38	82
8	472	19	24	638	47	81	777	31	65
9	478	29	37	536	47	68	770	25	52
10	500	26	35	590	47	75	778	18	38
11	462	23	29	606	81	133	772	25	52
12	355	76	73	536	26	38	790	32	68
13	382	46	47	530	41	59	771	28	58
14	462	18	22	521	32	45	699	32	60
15	485	38	50	490	57	75	645	25	44
16	475	31	40	485	74	97	622	34	57
17	490	14	19	367	91	90	675	48	87
18	506	22	30	472	63	80	1180	316	1010
19	506	57	78	455	96	118	1080	187	545
20	495	15	20	478	94	121	933	60	151
21	495	29	39	533	73	105	843	56	127
22	478	26	34	522	108	152	773	86	179
23	475	24	31	519	66	92	734	84	166
24	470	22	28	504	73	99	665	80	144
25	480	23	30	557	119	179	625	63	106
26	492	33	44	684	57	105	594	72	115
27	485	22	29	884	89	212	605	68	111
28	475	11	14	1130	146	445	604	94	153
29	472	10	13	--	--	--	653	64	113
30	465	19	24	--	--	--	691	75	140
31	460	28	35	--	--	--	693	64	120
TOTAL	14540	--	986.6	16097	--	3624.6	24319	--	6049

Figure A147. Example of data for Enterprise, Kansas (Source: Water Resources Data for Kansas, 1975, USGS, Lawrence, Kansas) (sheet 1 of 2)

06877600 SMOKY HILL RIVER AT ENTERPRISE, KS.--Continued

SUSPENDED-SEDIMENT DISCHARGE, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	644	58	101	784	148	313	1180	365	1160
2	614	51	85	724	132	258	1120	402	1220
3	587	22	35	730	127	250	1360	386	1420
4	572	41	63	780	146	307	2400	1010	6540
5	578	30	47	817	150	331	2210	1080	6440
6	573	48	74	782	125	264	1650	782	3480
7	582	62	97	707	87	166	1970	1040	6240
8	675	98	179	669	137	247	2020	1300	7090
9	739	48	96	626	131	221	3790	1960	20100
10	664	45	81	590	128	204	5460	2450	36100
11	625	41	69	573	87	135	5690	1890	29000
12	599	39	63	556	141	212	3790	1140	11700
13	593	40	64	537	146	212	2870	1160	8990
14	671	42	76	527	135	192	2300	1030	6400
15	977	110	290	532	150	215	1960	744	3940
16	1050	72	204	521	149	210	1840	651	3230
17	1090	85	250	521	129	181	1850	698	3490
18	1000	77	208	495	130	174	1970	691	3680
19	854	69	159	462	132	165	2220	1020	6110
20	778	68	143	438	135	160	1950	652	3430
21	756	109	222	423	152	174	2100	649	3680
22	723	101	197	402	142	154	4230	2240	25600
23	695	95	178	398	147	158	8080	3230	70500
24	2000	2910	24900	399	138	149	12100	2500	81700
25	4200	3730	42300	389	106	111	14100	1990	75800
26	2920	1910	15100	387	134	140	13200	1580	56300
27	1630	714	3140	430	138	160	9000	1590	38600
28	1160	393	1230	503	159	216	6300	1510	25700
29	948	281	719	645	229	399	4420	1360	16200
30	851	166	381	980	498	1320	3480	1300	12200
31	--	--	--	1090	473	1390	--	--	--
TOTAL	30348	--	90751	18417	--	8788	126610	--	576040

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	SEDIMENT DISCHARGE (TONS/DAY)
1	2490	1310	8810	524	124	175	926	213	533
2	2900	1140	8930	490	116	153	1010	248	676
3	3130	887	7500	462	121	151	935	200	505
4	3540	819	7830	430	112	130	857	199	460
5	4180	940	10600	405	91	100	764	185	382
6	4380	755	8930	391	94	99	572	157	242
7	4350	734	8620	370	102	102	516	129	180
8	4310	690	8030	356	143	137	648	148	259
9	4270	716	8250	349	97	91	1090	372	1090
10	4420	587	7010	339	116	106	932	680	1710
11	4450	680	8170	336	93	84	840	384	871
12	4430	667	7980	337	100	91	855	292	674
13	4090	629	6950	372	150	151	750	214	433
14	2790	539	4060	452	150	183	695	214	402
15	1920	464	2410	597	159	256	667	174	313
16	1680	424	1920	978	303	800	653	160	282
17	1560	401	1690	2510	2310	15700	647	147	257
18	1270	368	1260	2560	3130	21600	649	136	238
19	1090	310	912	1800	2160	10500	717	134	259
20	1130	323	985	1270	1110	3810	715	136	263
21	1160	320	1000	1230	841	2790	685	121	224
22	1150	321	997	944	603	1540	680	116	213
23	1140	339	1040	858	347	804	662	110	197
24	1120	342	1030	1130	620	1890	666	116	209
25	1110	533	1600	1170	505	1600	666	121	218
26	1110	312	935	1160	438	1370	636	118	203
27	1110	313	938	1160	380	1190	573	108	167
28	1090	280	824	1180	361	1150	459	90	112
29	1080	270	787	1200	346	1120	422	80	91
30	930	226	567	1280	354	1220	405	97	106
31	646	160	279	1110	271	812	--	--	--
TOTAL	74026	--	130844	27750	--	69905	21292	--	11769

TOTAL DISCHARGE FOR YEAR (CFS-DAYS) 415646
TOTAL SUSPENDED-SEDIMENT DISCHARGE FOR YEAR (TONS) 953618.2

Figure A147 (sheet 2 of 2)

Smoky Hill River at New Cambria, Kansas

Station identification

OWDC No.: 50243

Agency station No.: 06870200

Latitude/longitude: 385113/972752

Agency reporting to OWDC: USGS

River mile: 83.9 (Mile 0 is at the confluence of the Smoky Hill and Republican rivers; established by the CE in 1969.)

Site description

From 1962 to September 1968, the sediment sample collection and stream gaging stations were on the Saline County Highway bridge that crosses the Smoky Hill River 3 miles southwest of New Cambria (Figure A148). This location is 15.4 miles upstream from the confluence of the Smoky Hill and Solomon rivers and 8.1 miles downstream from the confluence of the Saline and Smoky Hill rivers. Flow is moderately regulated by Kanopolis Dam 99.8 miles upstream (storage began in the reservoir 17 February 1948) and slightly regulated by Wilson Dam (storage in the reservoir began 29 December 1964). The gradient through this reach is 1.2 ft/mile, and the streambed material consists of fine sand. There is no bank protection, and the stream is not navigable for commercial traffic at this site. Upstream from the station, the land is used primarily for agriculture. The discharges of record (October 1962 to the present) are: maximum - 26,400 cfs; mean - 694 cfs; and minimum - 18 cfs. The sediment loads of record (October 1962 - September 1968) are: maximum - 98,000 tons/day; mean - 402 tons/day; and minimum - 0.5 ton/day.

Station chronological record

The sediment station was established by the USGS Kansas District in October 1962; collection of sediment samples was discontinued in September 1968. Samples were collected for chemical analysis from October 1962 to September 1970 and from October 1973 to the present. River stage has been measured from 1962 to the present. The sediment station was established to monitor sediment flow between the confluence of the

Solomon and Smoky Hill rivers (upstream from the station) and the confluence of the Saline and Smoky Hill rivers (downstream from the station). During the period of record, the USGS Kansas District was responsible for collecting and analyzing the samples, as well as for reducing and reporting the resulting data.

Sample and data
collection procedures

Information regarding the collection of sediment samples is identical to that presented for the Kansas River sediment sample collection station at Wamego, Kansas (prior to 1 October 1975).

River stage has been measured during the period of record (1962 to the present) with the devices given in the following tabulation:

Period	Device Used
1962 - present	Wire-weight gage
1963 - present	Stevens graphical recorder
1964 - present	Fisher-Porter automatic digital recorder, Model 1542

Laboratory sample analysis

Information is identical to that presented for the Kansas River sediment sample collection station at Wamego, Kansas.

Data reduction procedures

Information is identical to that presented for the Kansas River sediment sample collection station at Wamego, Kansas.

Data reporting procedures

Suspended-sediment data were published in Reference 22. Discharge data have been published daily from September 1962 to the present in Reference 10. Figure A149 shows an example of the data reported for this station.

General information

Sediment and discharge records for this station are considered good. Additional information can be obtained from: District Chief, Water Resources Division, U. S. Geological Survey, 1950 Avenue A - Campus West, University of Kansas, Lawrence, Kansas 66045.

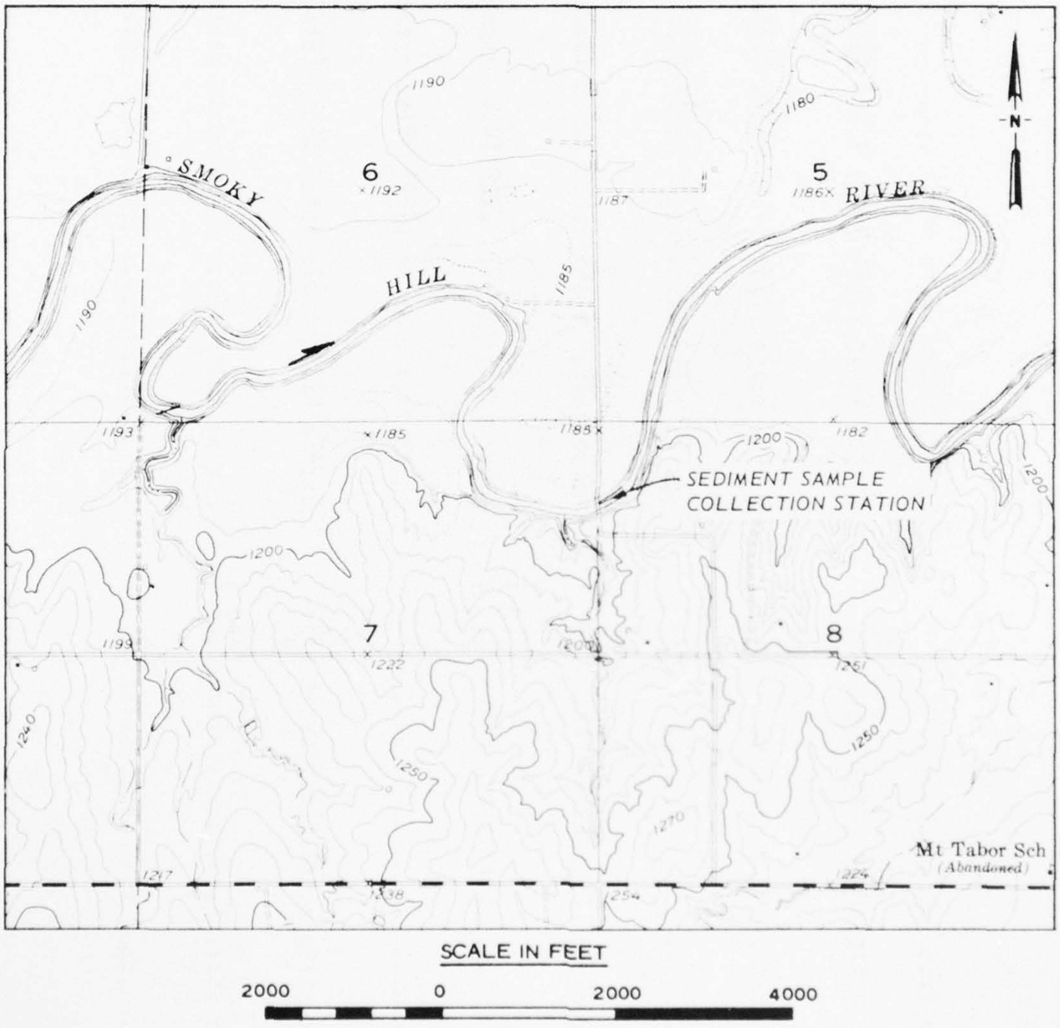

Figure A148. Site location for New Cambria, Kansas, sediment sample collection station (Source: USGS Quadrangle Map for Kipp, Kansas, 1955)

KANSAS RIVER BASIN

6-8702. SMOKY HILL RIVER AT NEW CAMBRIA, KANS.

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

	OCTOBER			NOVEMBER			DECEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)
1	1250	830	2800	216	91	53	157	32	14
2	1130	540	1600	218	86	51	158	45	19
3	1060	600	1700	225	69	42	156	29	12
4	1000	570	1500	225	92	56	153	35	14
5	959	480	1200	216	92	54	151	28	11
6	942	680	1700	207	66	37	151	26	11
7	1600	2000	8600	193	56	29	149	15	6
8	2360	2300	15000	191	74	38	142	13	5
9	1550	610	2600	188	200	100	144	10	4
10	1020	530	1500	256	200	140	144	11	4
11	893	480	1200	634	540	920	142	12	5
12	837	400	900	652	440	770	143	13	5
13	894	480	1200	652	250	440	144	10	4
14	1000	470	1300	660	320	570	143	10	4
15	1050	600	1700	473	230	290	141	20	8
16	1240	1400	4700	257	200	140	139	20	8
17	1030	540	1500	220	130	77	152	20	8
18	623	340	570	200	34	18	159	20	9
19	390	230	240	192	40	21	165	20	9
20	343	180	170	186	59	30	177	20	10
21	312	150	130	180	65	32	165	20	9
22	295	280	220	178	74	36	159	20	9
23	277	140	100	172	40	19	148	20	8
24	263	130	92	171	37	17	141	20	8
25	251	130	88	167	35	16	135	20	7
26	239	110	71	165	19	8	130	20	7
27	236	120	76	161	31	13	125	20	7
28	223	130	78	154	27	11	120	20	6
29	219	69	41	154	21	9	115	20	6
30	212	73	42	155	24	10	110	20	6
31	206	100	56	--	--	--	105	20	6
TOTAL	23904	--	52674	7918	--	4047	4463	--	249

	JANUARY			FEBRUARY			MARCH		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)
1	100	10	3	142	20	8	93	79	20
2	100	10	3	140	20	8	161	77	33
3	100	10	3	137	20	7	117	100	32
4	100	10	3	136	20	7	112	100	30
5	100	10	3	135	20	7	107	70	20
6	100	10	3	133	20	7	109	45	13
7	100	10	3	130	20	7	105	42	12
8	100	10	3	127	20	7	103	47	13
9	100	10	3	126	20	7	103	52	14
10	100	10	3	126	20	7	102	18	5
11	100	10	3	126	20	7	101	24	7
12	100	10	3	125	20	7	99	20	5
13	100	10	3	121	20	7	98	34	9
14	100	10	3	115	20	6	99	38	10
15	100	10	3	122	20	7	96	17	4
16	100	15	4	130	15	5	96	36	9
17	100	15	4	128	15	5	92	48	12
18	105	15	4	122	15	5	94	56	14
19	115	15	5	120	15	5	89	31	7
20	130	15	5	122	15	5	90	21	5
21	135	15	5	121	15	5	91	23	6
22	145	15	6	118	15	5	90	35	9
23	150	15	6	116	15	5	90	44	11
24	155	15	6	123	15	5	90	25	6
25	160	15	6	131	15	5	89	23	6
26	155	15	6	126	15	5	87	24	6
27	153	15	6	125	15	5	89	20	5
28	149	15	6	87	15	4	84	30	7
29	149	15	6	75	15	3	81	31	7
30	145	15	6	--	--	--	81	38	8
31	142	15	6	--	--	--	82	70	15
TOTAL	3688	--	132	3585	--	173	3020	--	360

Figure A149. Example of sediment data for New Cambria, Kansas (Source: Water Resources Data for Kansas, 1968, USGS, Lawrence, Kansas) (sheet 1 of 2)

KANSAS RIVER BASIN

6-8702. SMOKY HILL RIVER AT NEW CAMBRIA, KANS.--Continued

DAILY SUSPENDED SEDIMENT, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

	APRIL			MAY			JUNE		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)
1	80	47	11	107	230	66	98	1800	480
2	80	41	9	101	220	60	106	230	66
3	187	670	340	98	180	48	128	130	45
4	306	730	600	97	140	37	107	160	46
5	356	840	810	96	100	26	93	150	38
6	181	230	110	96	100	26	85	160	37
7	139	240	90	110	100	30	79	110	23
8	122	120	40	113	110	34	76	190	39
9	109	73	21	109	130	38	87	180	42
10	106	60	17	100	140	38	101	170	46
11	103	65	18	97	160	42	99	70	19
12	99	67	18	97	150	39	101	80	22
13	97	52	14	101	170	46	61	180	30
14	164	240	110	130	190	67	54	180	26
15	273	800	590	117	210	66	131	220	78
16	179	680	330	113	180	55	247	440	290
17	166	640	290	102	190	52	333	660	590
18	120	300	97	95	200	51	224	480	290
19	114	170	52	95	200	51	140	290	110
20	223	230	140	94	190	48	114	110	34
21	276	400	300	93	160	40	104	120	34
22	196	270	140	235	2100	1300	98	110	29
23	144	170	66	449	1000	1200	152	260	110
24	127	140	48	258	520	360	177	250	120
25	115	110	34	209	240	140	122	270	89
26	113	92	28	159	230	99	99	180	48
27	111	84	25	143	260	100	89	180	43
28	114	310	95	145	220	86	81	79	17
29	113	290	88	128	180	62	74	81	16
30	111	250	75	113	180	55	67	64	12
31	--	--	--	106	200	57	--	--	--
TOTAL	4624	--	4606	4106	--	4419	3527	--	2869

	JULY			AUGUST			SEPTEMBER		
DAY	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)	MEAN DISCHARGE (CFS)	MEAN CONCEN-TRATION (MG/L)	LOAD (TONS)
1	62	45	8	73	53	10	264	660	470
2	62	30	5	109	90	26	138	660	250
3	59	33	5	118	85	27	96	660	170
4	53	48	7	118	76	24	85	480	110
5	51	29	4	145	100	39	80	320	69
6	50	30	4	105	46	13	81	74	16
7	53	35	5	80	48	10	84	62	14
8	49	42	6	70	44	8	73	77	15
9	58	57	9	63	32	5	66	91	16
10	54	30	4	59	45	7	64	82	14
11	45	52	6	55	46	7	65	52	9
12	54	57	8	52	45	6	62	50	8
13	65	64	11	50	27	4	61	49	8
14	49	52	7	49	36	5	59	46	7
15	41	96	11	47	38	5	59	69	11
16	36	51	5	52	53	7	59	70	11
17	51	48	7	59	98	16	62	63	11
18	48	52	7	52	71	10	60	67	11
19	40	30	3	47	47	6	76	74	15
20	35	31	3	46	65	8	77	100	21
21	33	21	2	46	58	7	66	73	13
22	32	30	3	46	40	5	61	82	14
23	31	23	2	44	39	5	60	68	11
24	32	29	3	46	36	4	60	76	12
25	38	42	4	46	40	5	57	83	13
26	39	38	4	44	48	6	210	800	450
27	48	130	17	47	51	6	760	2200	4500
28	93	130	33	96	200	52	987	2500	6700
29	110	110	33	87	120	28	1730	1700	7900
30	101	82	22	81	140	31	1440	1300	5100
31	56	67	10	296	2100	1700	--	--	--
TOTAL	1628	--	258	2328	--	2092	7102	--	25969

TOTAL DISCHARGE FOR YEAR(CFS-DAYS) 69893.0
TOTAL LOAD FOR YEAR (TONS) 97848

Figure A149 (sheet 2 of 2)

AD-A039 571 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 8/8
INVENTORY OF SEDIMENT SAMPLE COLLECTION STATIONS IN THE MISSISS--ETC(U)
MAR 77 M P KEOWN, E A DARDEAU, J G KENNEDY

UNCLASSIFIED WES-TR-M-77-1 NL

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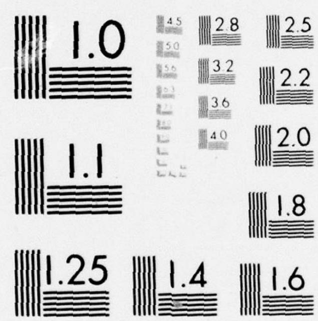

MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

Smoky Hill River Below Kanopolis Dam, Kansas

Station identification

OWDC No.: 54677

Agency station No.: 196-1

Latitude/longitude: 383700/975800

Agency reporting to OWDC: CE

River mile: 183.7 (Mile 0 is at the confluence of the Smoky Hill and Republican rivers; established by the CE in 1969.)

Site description

From May 1947 to September 1967, the sediment sample collection station was at the downstream end of the discharge outlet tunnel at Kanopolis Dam (Figure A150). The dam, a rolled-earth-filled embankment 15,300 ft long and rising 131 ft above the streambed, is 12 miles southeast of Kanopolis, Kansas. Storage in the reservoir began 17 February 1948. Riprap has been placed on the banks in the vicinity of the site. The streambed material is sandy gravel, and the channel gradient downstream from the site is 2.5 ft/mile. This river is not navigable for commercial traffic. Although there is some agricultural activity downstream from the site, none is practiced in the immediate vicinity. The gaging station is 0.8 mile downstream from the dam near Langley, Kansas. Annual soil loss due to erosion upstream from the stations is 500-1,000 tons/square mile. The discharges of record prior to closure of the dam (October 1940 to February 1948) are: maximum - 21,800 cfs; and minimum - 5 cfs. (A mean discharge value for this period is not available.) The discharges after closure of the dam (February 1948 to the present) are: maximum - 5,570 cfs; mean - 353 cfs; and minimum - 0.40 cfs. The sediment loads of record prior to closure of the dam (May 1947 to February 1948) are: maximum - 10,230 tons/day; mean - 139 tons/day; and minimum - 0.31 ton/day. The sediment loads of record after the dam was closed until the sediment station was discontinued (July 1948 to September 1967) are: maximum - 2,365 tons/day; mean - 68 tons/day; and minimum - 2.7 tons/day. The flow is completely regulated by Kanopolis Dam.

Station chronological record

The sediment station was established in May 1947 by the CE Kansas City District (KCD) and operated until September 1967 to monitor the sediment passing through the outfall of the dam and thus determine the trapping efficiency of Kanopolis Reservoir. During the period of record, samples were collected by the KCD personnel stationed at the dam. The samples were analyzed in the KCD Laboratory, and the resulting data were reduced and reported by the KCD.

Sample and data collection procedures

Surface milk-bottle grab samples were collected weekly by the KCD personnel. Samples for chemical analysis were also obtained.

The gaging station at Langley, Kansas (mile 182.9) was established by the USGS Kansas District on 24 October 1940. The following tabulation lists the gaging and recording devices used at this station during the period of record:

Period	Device Used
24 October 1940 - present	Stevens A-35 water-stage recorder (driven by manometer since 1965)
24 October 1940 - present	Wire-weight gage
1965 - present	Fisher-Porter automatic digital recorder driven by manometer

Laboratory sample analysis

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reduction procedures

Information is identical to that presented for the Big Blue River sediment sample collection station below Tuttle Creek Dam, Kansas.

Data reporting procedures

Daily suspended-sediment load data were published from May 1947 through September 1967 in Reference 11. Daily discharge data were

published from 1940 to 1961 in Reference 12 and since 1961 in Reference 10. Figures A151 and 152 show examples of data published for these stations.

General information

Sediment and discharge records for this station are considered to be good. Additional information on this station can be obtained from: U. S. Army Engineer District, Kansas City, Hydrologic Engineering Branch, Water Control Section, 700 Federal Building, 601 East 12th Street, Kansas City, Missouri 64106.

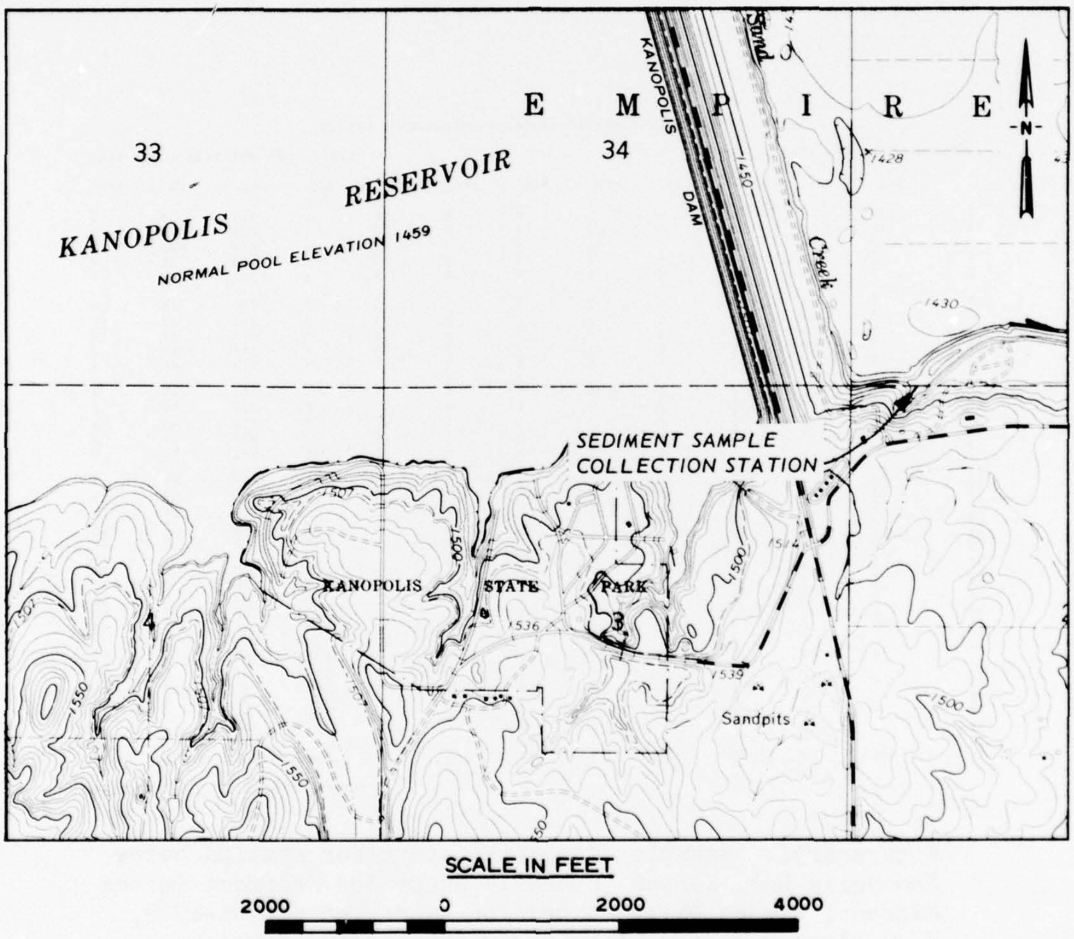

Figure A150. Site location for below Kanopolis Dam, Kansas, sediment sample collection station (Source: USGS Quadrangle Map for Langley, Kansas, 1964)

SMOKY HILL RIVER AT KANOPOLIS RESERVOIR, KANSAS

SUSPENDED SEDIMENT LOAD - TONS   WATER YEAR OCT 1966 - SEP 1967

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	1	1	1	1	0	2	10	1	510	53	4
2	10	1	1	1	1	0	2	10	1	329	51	4
3	7	1	1	1	1	1	3	12	2	475	350	7
4	7	1	1	1	1	1	3	5	2	155	31	7
5	7	1	1	1	1	1	3	3	1	223	59	10
6	5	1	1	1	1	1	4	3	2	378	43	10
7	5	0	1	1	1	1	4	3	4	553	16	12
8	7	0	1	1	1	1	5	2	4	548	31	10
9	7	0	1	1	1	1	5	2	4	378	47	7
10	9	0	1	1	1	1	5	2	4	507	46	5
11	12	0	1	1	1	1	4	2	4	486	15	2
12	54	0	1	1	1	1	4	2	5	229	30	2
13	54	0	1	1	1	1	4	1	7	236	43	2
14	162	1	1	1	1	1	3	1	38	157	14	2
15	54	1	1	1	1	1	3	1	41	241	85	5
16	81	1	1	1	1	1	4	1	41	637	26	5
17	81	1	1	1	1	1	3	1	27	302	14	5
18	29	1	1	1	1	1	9	1	61	289	13	5
19	0	1	1	1	1	1	11	1	23	281	7	11
20	0	1	1	1	1	1	6	1	68	205	3	30
21	1	1	0	1	1	1	8	1	78	265	3	56
22	1	1	0	1	0	2	11	1	43	149	5	59
23	1	1	0	1	0	2	11	2	86	63	5	58
24	1	1	0	1	0	2	14	2	152	18	7	57
25	1	1	0	1	0	3	12	2	154	46	7	55
26	1	1	0	1	0	3	9	3	156	12	7	77
27	1	1	1	1	0	2	9	4	104	41	9	75
28	1	1	1	1	0	2	9	3	359	90	9	110
29	1	1	1	1		2	8	2	259	20	9	108
30	1	1	1	1		2	10	2	331	32	7	108
31	1		1	1		2		2		50	4	
	612	23	25	31	21	41	190	88	2,062	7,905	1,051	908

YEARLY TOTAL = 12,957 TONS

Figure A151. Example of sediment data for station below Kanopolis Dam, Kansas (Source: Suspended Sediment in the Missouri River, Daily Record for Water Years 1965-1969, U. S. Army Engineer District, Omaha, Omaha, Nebraska, May 1972)

KANSAS RIVER BASIN

06865500 SMOKY HILL RIVER NEAR LANGLEY, KANS.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1966 TO SEPTEMBER 1967

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	86	15	14	15	20	17	24	84	19	3,240	2,020	90
2	83	15	14	15	20	17	24	83	22	3,120	1,950	88
3	83	14	13	15	15	17	23	60	28	3,000	1,590	98
4	83	14	13	15	7.2	18	23	19	30	2,900	734	98
5	82	15	13	15	9.4	19	23	18	32	2,830	576	98
6	80	15	13	15	9.0	19	23	19	32	2,770	618	98
7	80	15	14	14	9.0	19	23	21	33	2,830	620	98
8	78	15	14	14	9.0	18	21	21	36	2,790	620	97
9	77	15	14	21	9.4	17	22	21	36	2,720	612	98
10	77	15	14	22	10	17	22	21	40	2,640	599	96
11	362	14	14	16	11	18	22	22	48	2,180	585	95
12	504	14	14	15	12	18	28	22	56	1,370	574	93
13	801	14	14	15	12	18	29	21	259	2,090	560	96
14	944	14	14	15	13	17	31	21	646	2,870	547	95
15	938	14	14	15	16	17	32	20	659	3,030	533	94
16	916	14	14	15	14	18	34	20	663	3,010	520	93
17	943	14	14	15	14	19	62	20	714	2,930	509	94
18	19	14	14	15	14	18	100	20	829	2,830	341	102
19	1.0	15	14	15	14	16	100	20	1,100	2,750	160	406
20	7.6	15	15	16	14	18	100	19	1,430	2,650	158	576
21	15	15	15	17	14	18	98	19	809	2,260	156	689
22	16	15	14	17	15	18	95	19	1,190	1,110	130	702
23	16	15	14	17	15	18	93	18	1,730	801	93	692
24	15	15	14	18	14	17	91	18	1,840	531	93	669
25	14	15	14	18	14	18	91	18	1,940	361	93	812
26	14	15	14	19	14	19	89	17	1,980	442	93	847
27	14	16	14	17	17	19	88	16	2,830	1,060	93	877
28	14	15	14	18	16	19	87	16	3,340	1,190	92	1,020
29	15	15	14	18	------	19	87	20	3,290	581	91	1,000
30	15	16	14	18	------	19	88	20	3,210	611	91	975
31	15	------	14	19	------	20	------	20	------	1,150	90	------
TOTAL	6,007.6	442	432	509	371.0	559	1,673	773	28,871	64,647	15,541	10,986
MEAN	194	14.7	13.9	16.4	13.3	18.0	55.8	24.9	962	2,085	501	366
MAX	944	16	15	22	20	20	100	84	3,340	3,240	2,020	1,020
MIN	1.0	14	13	14	7.2	16	21	16	19	361	90	88
AC-FT	11,920	877	857	1,010	736	1,110	3,320	1,530	57,270	128,200	30,830	21,790

CAL YR 1966 TOTAL 57,532.5 MEAN 158 MAX 1,040 MIN 1.0 AC-FT 114,100
WTR YR 1967 TOTAL 130,811.6 MEAN 358 MAX 3,340 MIN 1.0 AC-FT 259,500

Figure A152. Example of discharge data for near Langley, Kansas (station below Kanopolis Dam) (Source: Surface-Water Supply of the United States 1966-1970, Part 6, Missouri River Basin, U. S. Government Printing Office, Washington, D. C., 1972)

Solomon River at Niles, Kansas

Station identification

OWDC No.: 50249

Agency station No.: 06876900

Latitude/longitude: 385808/972834

Agency reporting to OWDC: USGS

River mile: 21.6 (Mile 0 is at the confluence of the Smoky Hill and Solomon rivers; established by the CE in 1969.)

Site description

The sediment sample collection and stream-gaging stations are on an Ottawa County Highway Bridge that crosses the nonnavigable (for commercial traffic) Solomon River 0.8 mile west of Niles, Kansas (Figure A153). In this vicinity the streambanks are unprotected, and the adjacent land is used primarily for agriculture. The streambed material consists of silt and occasionally fine sand, and the channel gradient through this reach is 1.5 ft/mile. Annual soil loss due to erosion upstream is 500-1,000 tons/square mile. Natural flow has been regulated since 1969 by Glen Elder Dam and to a lesser degree by many small diversions for irrigation. From 1917 to 1969, the discharges of record are: maximum - 178,000 cfs; mean - 580 cfs; and minimum - 1 cfs. From 1969 to the present, the discharges of record are: maximum - 26,200 cfs; mean - 520 cfs; and minimum - 12 cfs. From 1957 to 1969, the sediment loads of record are: maximum - 83,200 tons/day; mean - 11,200 tons/day; and minimum - 6 tons/day. From 1969 to the present, the sediment loads of record are: maximum - 45,400 tons/day; mean - 2,841 tons/day; and minimum - 0.0 ton/day.

Station chronological record

The sediment station was established by the USGS Kansas District in 1957 to monitor the sediment contribution of the Solomon River to the Smoky Hill River. During the period of record, the collection and analysis of samples, as well as the reduction and publication of the resulting data, have been the responsibility of the USGS Kansas District.

Sample and data
collection procedures

During the period of record, the USGS Kansas District took depth-integrated samples on a periodic (usually monthly) basis, following the collection procedures used by the USGS for taking monthly samples at the Kansas River sediment sample collection at Wamego, Kansas.

The USGS has been gaging in the vicinity of Niles since May 1897, except for the period from 1 October 1903 through 30 September 1917. The following tabulation summarizes the locations of the gaging and recording devices used during the period of record:

Period	Locality	Device Used
May 1897 - 30 November 1903	Niles (mile 21.6)	Nonrecording gage
1 October 1917 - 31 May 1919	Darling Point Highway Bridge near Bennington (mile 48.6)	Enameled staff gage
1 June 1919 - 10 February 1939	Downstream side of Ottawa County Highway Bridge, Niles (mile 21.6)	Chain-and-weight gage
26 April 1934 - present	Downstream side of Ottawa County Highway Bridge, Niles (mile 21.6)	Stevens A-35 Continuous water-stage recorder
11 February 1939 - present	Downstream side of Ottawa County Highway Bridge, Niles (mile 21.6)	Chain-and-weight gage
22 March 1963 - present	Downstream side of Ottawa County Highway Bridge, Niles (mile 21.6)	Fisher-Porter automatic digital recorder, Model 1542, driven by manometer*

* With binary decimal transmitter, which enables query by National Weather Service.

Laboratory sample analysis

Samples were analyzed at the USGS Laboratory in Lawrence, Kansas. Standard USGS procedures (and laboratory sheets) are used to determine

the concentration of suspended sediment present in each sample (Reference 1b).

Data reduction procedures

Daily sediment loads are computed by multiplying the product of the mean daily discharge (cfs) and the mean concentration (mg/l) by 0.0027 to convert to tons per day. This computation has been automated since 1972.

Data reporting procedures

Suspended-sediment load data were published through water year 1960 in Reference 16 and since that date in Reference 22. Beginning with water year 1975, only monthly values are being published in Reference 22. Discharge data were published for years prior to water year 1961 in Reference 12 and since that date in Reference 10. Figure A154 shows an example of discharge and suspended-sediment data for this station. These data are also included in the Environmental Protection Agency's STORET System.

General information

Sediment and discharge records are considered to be good, except those for the winter months, which are poor. Additional information on this station can be obtained from the District Chief, Water Resources Division, U. S. Geological Survey, 1950 Avenue A - Campus West, University of Kansas, Lawrence, Kansas 66045.

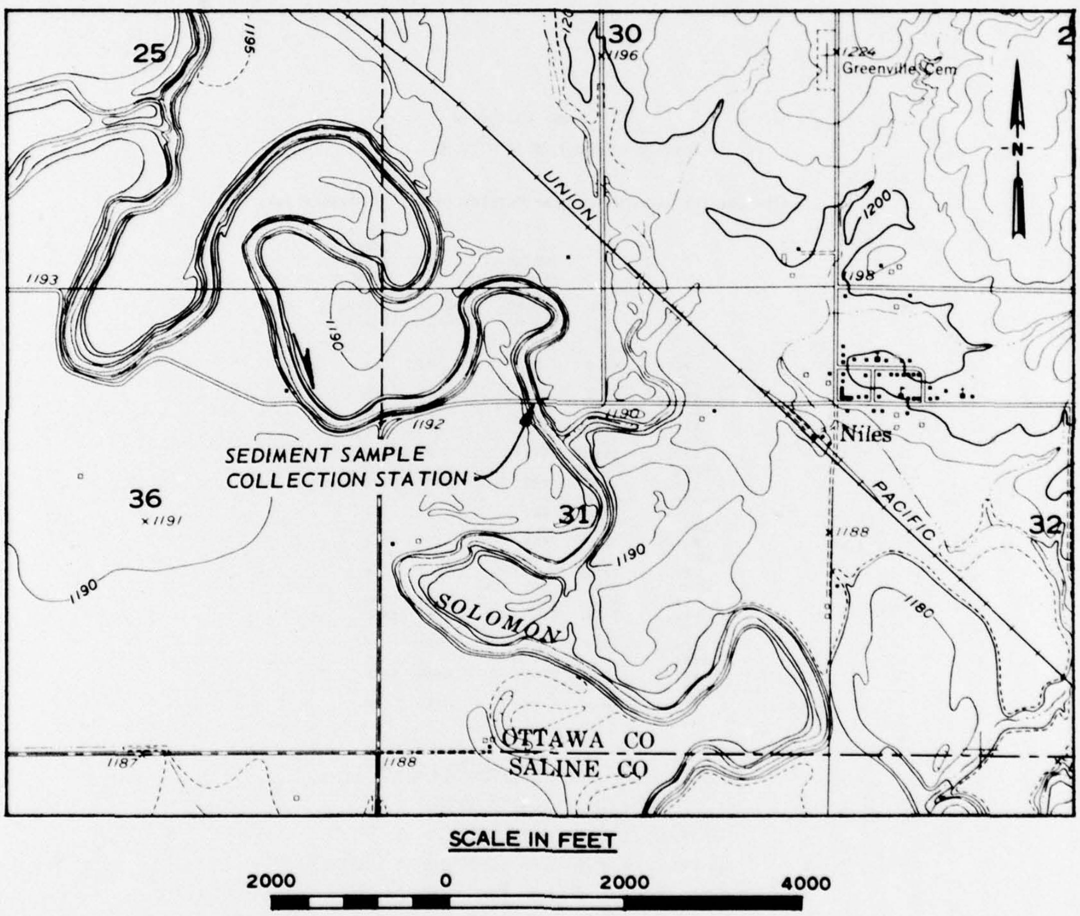

Figure A153. Site location for Niles, Kansas, sediment sample collection station (Source: USGS Quadrangle Map for Niles, Kansas, 1955)

KANSAS RIVER BASIN

06876900 SOLOMON RIVER AT NILES, KS.

WATER QUALITY DATA, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DATE	TIME	INSTAN-TANEOUS DIS-CHARGE (CFS)	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)
OCT.				
09...	1015	102	80	22
NOV.				
20...	1030	110	40	12
DEC.				
11...	1130	105	14	4.0
JAN.				
08...	1530	115	30	9.3
FEB.				
27...	1030	299	988	798
MAR.				
24...	1525	267	70	50
APR.				
24...	1310	269	197	143
MAY				
19...	0915	108	262	76
JUNE				
10...	1140	1430	1060	4090
25...	1055	6120	1740	28800
JULY				
22...	1310	129	276	96
AUG.				
20...	1115	764	2650	5470
SEP.				
17...	1045	96	145	38

Figure A154. Example of instantaneous discharge and suspended-sediment data for Niles, Kansas (Source: Water Resources Data for Kansas, 1975, USGS, Lawrence, Kansas)

Wapsipinicon River near DeWitt, Iowa

Station identification

OWDC No.: 54610

Agency station No.: None, only name is used by agency

Latitude/longitude: 414555/903200

Agency reporting to OWDC: CE

River mile: 18.2 (Mile 0 is at the confluence of the Wapsipinicon and Mississippi rivers; established by the CE about 1935.)

Site description

The sediment and gaging stations are on the U. S. Highway 61 Bridge that crosses the Wapsipinicon River 4 miles south of DeWitt, Iowa (Figure A155). There is heavy tillage as well as some wooded areas near both banks in the vicinity of the sampling station; neither bank is protected, and there are no artificial levees. The sediment station is at the downstream end of a slight bend. The Wapsipinicon River is not navigable for commercial traffic, and virtually no commercial or industrial activities exist upstream from the station except some pleasure boating. The streambed material consists of sands and silts, and the approximate channel gradient in this reach is 2.0 ft/mile. The discharges measured during the period of record (June 1934 to the present) are: maximum - 29,900 cfs; mean - 1,447 cfs; and minimum - 70 cfs. No mean sediment load for the period of record (1943 to the present) is available, but the mean daily suspended-sediment load for water year 1974 was 4,883 tons/day.

Station chronological record

The sediment sample collection station was established in 1942 to determine sediment loads on the Wapsipinicon River because of the proposed reservoir upstream at Central City, Iowa. The reservoir was never constructed; however, the sampling program has been continued. Sample collection is a cooperative effort of the USGS Iowa District and the CE Rock Island District (RID). Suspended-sediment samples were analyzed by the RID Laboratory before 1967 and by the USGS Sedimentation Laboratory,

Iowa City, Iowa, since that date. Data reduction is the responsibility of the RID.

Sample and data
collection procedures

Depth-integrated suspended-sediment samples, as well as temperature and unofficial gage-height readings, have been collected daily (except on those days when the ice cover was too thick for sampling) since 1942 by USGS-paid observers. Prior to 1950, the Rock Island sampler was used, and since that time, the US D-43 sampler has been used to collect suspended-sediment samples. The Rock Island sampler is discussed in the description of the Des Moines River sediment sample collection station near Tracy, Iowa. The use of the US D-43 sampler is discussed in References 3 and 17.

River stage data have been collected daily by the USGS at their DeWitt gaging station since June 1934. From 1934 to 1965, river stage was recorded with a Stevens Type A recorder; this device was replaced by a Stevens A-35 recorder, which is in current use. The RID personnel furnish four discharge measurements annually to the USGS Iowa District.

Laboratory sample analysis

Information is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa.

Data reduction procedures

Information is identical to that presented for the Des Moines River sediment sample collection station near Tracy, Iowa.

Data reporting procedures

The daily suspended-sediment load values have never been published. The RID, however, is attempting to obtain computer printouts (for in-house use at present) of its data at least as far back as 1968. An example is shown in Figure A156. Daily discharge values are published by the USGS in Reference 15.

General information

Information concerning the sediment sample station on the Wapsipinicon River near DeWitt, Iowa, can be obtained from: U. S. Army Engineer District, Rock Island, Hydraulics Section, Clock Tower Building, Rock Island, Illinois 61201.

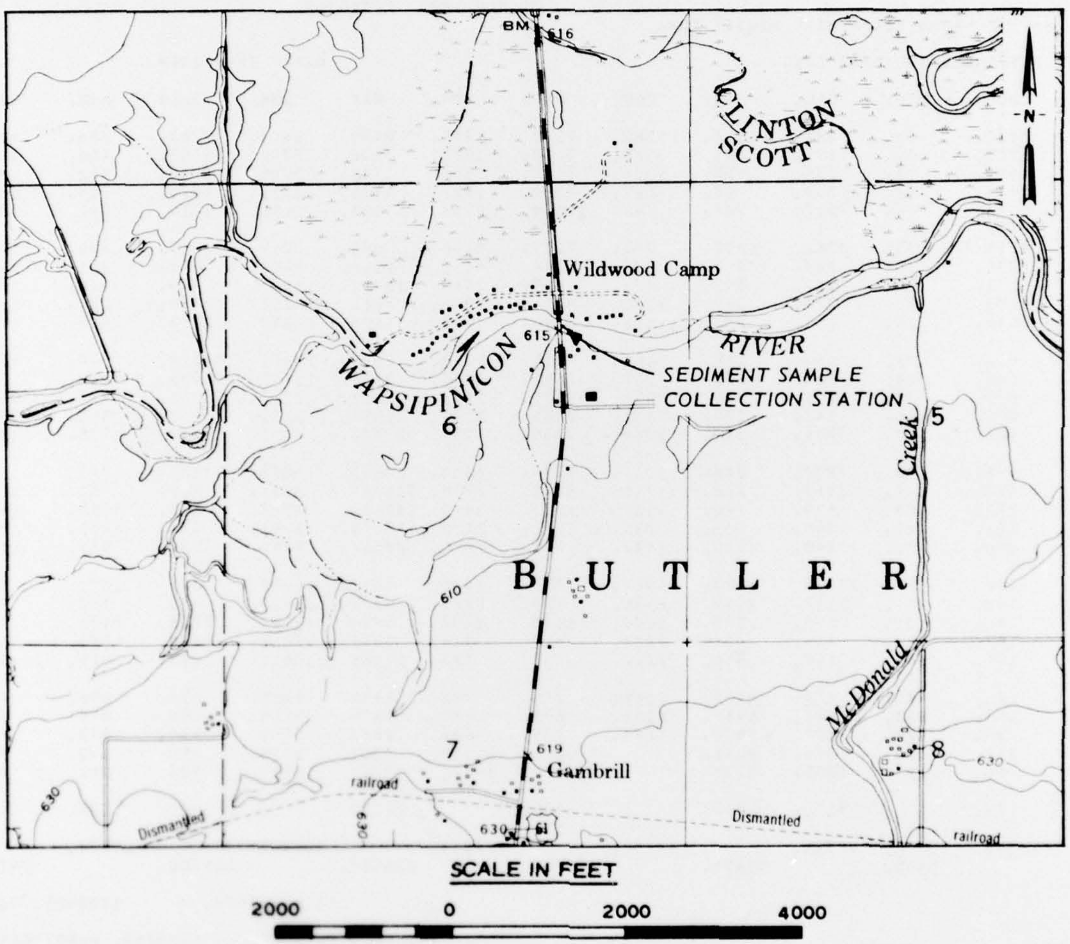

Figure A155. Site location for DeWitt, Iowa, sediment sample collection station (Source: USGS Quadrangle Map for DeWitt, Iowa, 1953)

31 MAR 1976 PETERSON

WAPSIPINICON RIVER NEAR DEWITT IOWA

DAILY SUSPENDED SEDIMENT LOAD WATER YEAR 1974

DAY	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.
1	1827.	78.	643.	527.	5382.	7175.	1719.	8930.	3414.	2787.	381.	184.
2	1135.	38.	179.	198.	3500.	3088.	1051.	3138.	3300.	2093.	405.	187.
3	1057.	36.	134.	155.	1364.	3223.	996.	1701.	5958.	1743.	497.	143.
4	1934.	34.	309.	67.	659.	5264.	1222.	1185.	2136.	1576.	304.	134.
5	1023.	35.	2517.	277.	746.	11668.	2024.	923.	2656.	1329.	291.	133.
6	1211.	35.	2362.	1437.	280.	7539.	2188.	648.	7215.	413.	250.	128.
7	738.	35.	905.	3416.	332.	6200.	4012.	1846.	4694.	790.	251.	143.
8	570.	35.	307.	549.	687.	4609.	2949.	10442.	10535.	794.	236.	153.
9	623.	30.	224.	317.	1572.	4216.	2260.	4011.	14323.	839.	219.	165.
10	646.	28.	164.	283.	1111.	3680.	1798.	1624.	14492.	2713.	408.	158.
11	872.	27.	166.	169.	1180.	2510.	1710.	2144.	13461.	34214.	534.	151.
12	680.	29.	83.	231.	2057.	2647.	2040.	3803.	11749.	46336.	612.	137.
13	605.	33.	151.	96.	2638.	2931.	2640.	5351.	7223.	11996.	1977.	157.
14	520.	38.	143.	126.	3452.	2364.	3540.	30554.	5111.	3260.	1363.	233.
15	486.	43.	939.	316.	1268.	2330.	6237.	27576.	4025.	2219.	1928.	150.
16	646.	38.	2230.	288.	1077.	2274.	6683.	13863.	3857.	1431.	745.	113.
17	427.	34.	1013.	202.	1796.	1633.	3750.	511855.	3931.	949.	760.	121.
18	272.	38.	403.	70.	4509.	1513.	3673.	149649.	4160.	873.	5052.	142.
19	261.	47.	566.	333.	3835.	1142.	3102.	48773.	6291.	656.	1453.	120.
20	260.	70.	10345.	4581.	1642.	943.	2876.	20967.	8254.	527.	936.	109.
21	208.	155.	24775.	4823.	1569.	748.	2445.	9312.	16908.	354.	1321.	73.
22	192.	262.	2117.	2912.	6431.	778.	2046.	9337.	34719.	810.	697.	46.
23	188.	131.	149.	977.	2978.	1108.	1493.	8414.	48999.	2218.	2138.	53.
24	187.	184.	405.	611.	2030.	819.	944.	6937.	22045.	2058.	1603.	58.
25	167.	454.	197.	546.	4217.	330.	773.	10134.	10611.	943.	429.	57.
26	131.	441.	479.	1137.	1143.	366.	743.	9452.	7221.	556.	492.	46.
27	115.	293.	563.	6466.	1011.	345.	947.	3466.	5684.	504.	370.	50.
28	94.	228.	502.	3520.	6244.	339.	2694.	2849.	7752.	454.	278.	48.
29	102.	195.	344.	2691.		826.	21110.	4261.	5728.	458.	142.	45.
30	60.	283.	1355.	3779.		3570.	14570.	13212.	3529.	438.	263.	42.
31	73.		4132.	11592.		1775.		10232.		389.	245.	
	17309.	3408.	58799.	52694.	64708.	87951.	104234.	936588.	299982.	126720.	26579.	3479.

YEARLY TOTAL = 1782451. TONS

TOTAL YEARLY DISCHARGE = 1915317. ACRE FEET

Figure A156. Example of sediment data for DeWitt, Iowa (printout provided by U. S. Army Engineer District, Rock Island)

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In accordance with ER 70-2-3, paragraph 6c(1)(b), dated 15 February 1973, a facsimile catalog card in Library of Congress format is reproduced below.

Keown, Malcolm Price
Inventory of sediment sample collection stations in the Mississippi River Basin, by Malcolm P. Keown, Elba A. Dardeau, Jr., [and] James G. Kennedy. Vicksburg, U. S. Army Engineer Waterways Experiment Station, 1977.
1 v. (various pagings) illus. 27 cm. (U. S Waterways Experiment Station. Technical report M-77-1)
Prepared for U. S. Army Engineer District, New Orleans, New Orleans, Louisiana, under Lower Mississippi Valley Division Potamology Program (T-1), Work Package 9, Sedimentation.
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TA7.W34 no.M-77-1